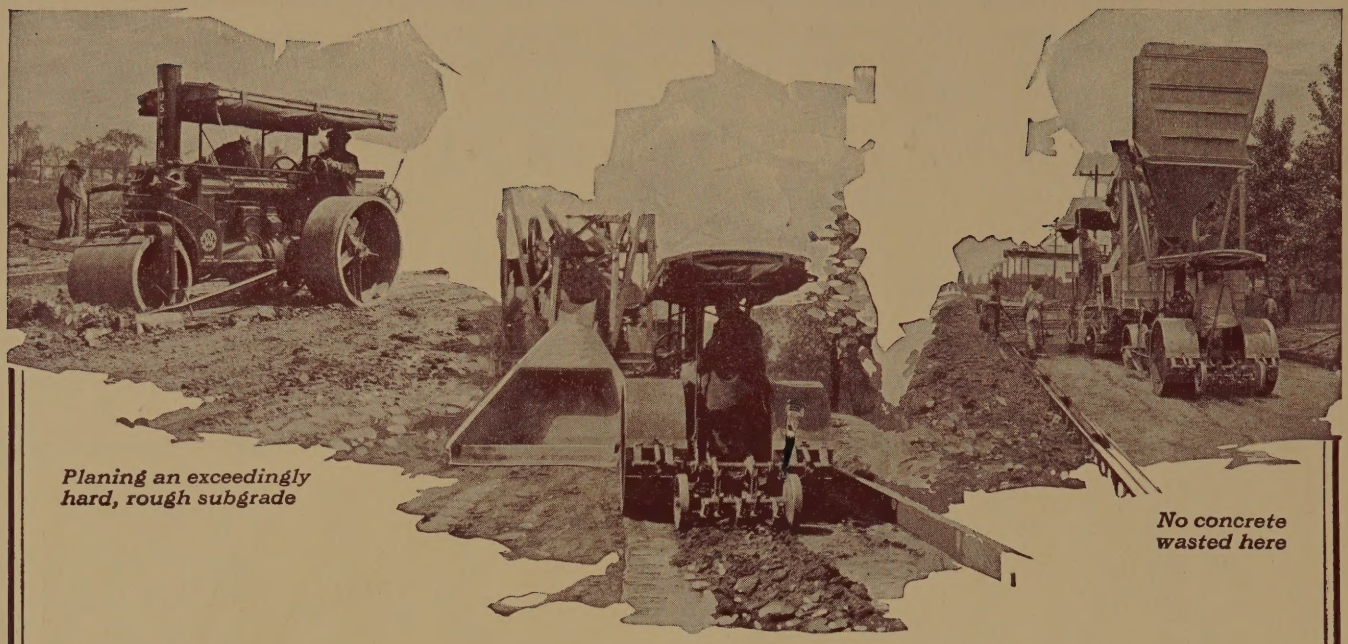
North Carolina Highway Bulletin

VOL. IV OCTOBER, 1923 No. 8



TOPTON—ROBBINSVILLE ROAD—GRAHAM COUNTY—PROJECT NO. 930



Planing an exceedingly hard, rough subgrade

Scarifying a ridge

No concrete wasted here

Save on the Subgrade with an Austin Pup

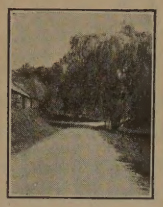
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NORTH CAROLINA HIGHWAY BULLETIN



VOL. IV, NO. 8 H. K. WITHERSPOON, Editor October, 1923

The One Road *to* Graham County

By W. F. Weller, *Resident Engineer*

PROJECT 930 has three especial points of value to the State. First it is the neck of the bottle for Graham County—the only outlet for the narrow fertile farms and vast acreage of virgin timber lands. The valleys of Graham County are completely surrounded by some of the roughest mountains in the Appalachians. Before the Highway Commission came to the rescue Graham County was practically cut off from the rest of the world during the winter months—and afforded no joy rides in the summer.

The second point for the road is that it affords one of the most beautiful views that can be offered our tourists.

Third, it is the first link in the proposed highway to Knoxville. Robbinsville, Graham County, is about equidistant from Asheville, Knoxville, and Atlanta.

Project 930, Route 108, is 12.45 miles long, twenty feet wide, and surfaced with the local substitute for gravel. Work was begun in September, 1921, and will probably be completed in October of this year. The grading and 9.5 miles of the surfacing were done by Lee J. Smith Construction Company of Charlotte, with State convict and Indian labor. The concrete and rubble masonry structures, and three miles of surfacing were done by C. M. Dicus of Mills Springs and Topton, N. C.

These contractors had their troubles. It rained ninety days out of the first six months they worked. But they didn't have all of the troubles. Graham County belles married most of the guards and foremen.

Leaving the Asheville-Murphy-Atlanta Highway, at Topton, about 3,000 feet above sea level, the road crosses the Southern Railway by an overhead bridge. It then runs two and a half miles near the top of the mountain, above the Nantahala valley, to Tulula Gap.

The side of the mountain here is too steep to permit a fill, except in some of the hollows. The road, therefore, had to be notched into the rock, high up above the valley. This made it necessary to wind the road in and around the curves and points of the mountain. It is one of the heaviest pieces of work in the State. Where it was possible to use tangents on this stretch, they are so short that they are not noticeable. The driver sees only a succession of compound and reverse curves. In this 2.65 miles there are 82 curves. It cost about $100,000.00.

To make this trip as safe as possible for the motorists, the outside of all the curves have been elevated. Each curve had to be worked out for itself. In speeding along the road it is hard to realize that each car length covered represents careful computation, and even more careful inspection, to see that the completed surface is the best that can be given the motorists in a safe smooth grade.

Surfacing for this highway brought out new conditions. These hills are almost entirely made of a slate rock. The rock is hard underneath, and lies in seams. Blasting for the grade required the skill of an old time powder man—and left his hair much whiter than it was. The rock rapidly decays when exposed to the air. It was therefore useless for surfacing.

This country is at the head of all its streams. The streams are shallow, and too swift for gravel deposits. A study was made and paragraphs inserted in the specifications especially to provide for the use of the mixture of small stone, sand and topsoil for a "gravel" surface.

On the left driving from Topton, are the nearly vertical sides of the cut, as high as 70 feet. On the right, the outer edge of the road is the brink of a steep, partly timbered, slope to the valley below. Driving along this road one sees a few hundred feet below the partly built grade of the late Graham County Railroad; several hundred feet below that, the Southern Railway; and still further down the mountain side is the road from Asheville, climbing up from the Nantahala River to meet our road at Topton. From near Tulula Gap can be seen the Nantahala Gorge, far up the river to the top of the Nantahala range; and the narrow valley down stream, walled in between steep towering mountains. This seen, from a thousand feet above the valley, is considered one of the most beautiful in America.

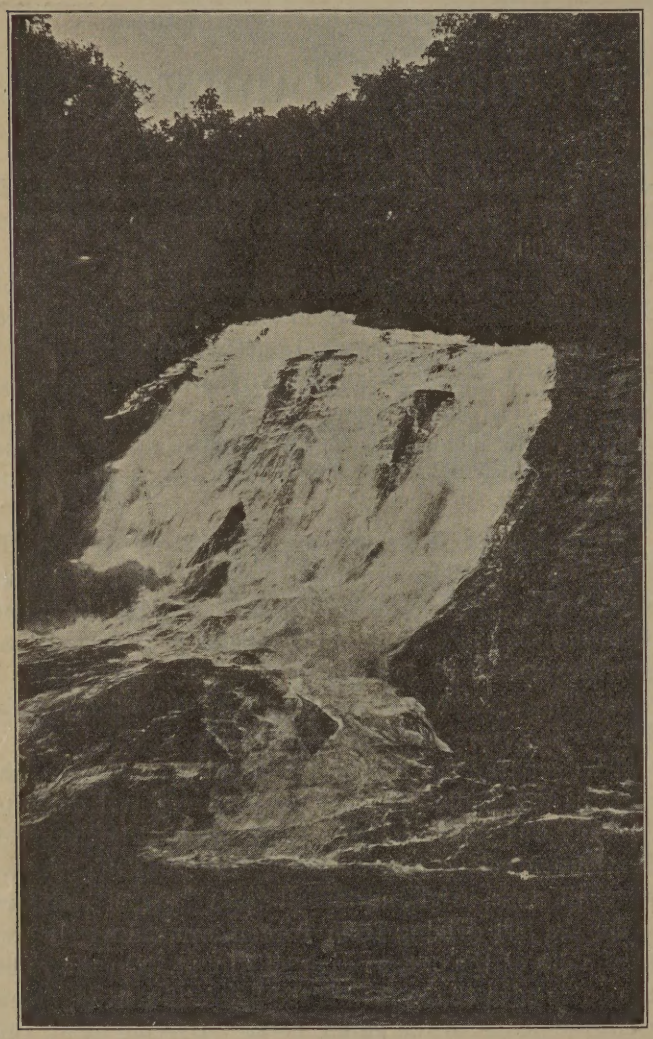
The turn through Tulula Gap is 140°. From there the highway runs along Tulula Creek, through timber lands and narrow farms to Robbinsville, the county seat of Graham County.

(Continued on page 12)

State Highway Project No. 952-"A"

By H. W. RAINEY, *Resident Engineer*

THIS project has its beginning about one mile north west of Glennville in Jackson County and ends where the Tuckaseigee River forks at Tuckaseigee, traversing a distance of 10.36 miles. It was originally planned to be built by the county and about one mile of it had been built when the State took it over.



TUCKASEIGEE FALLS FROM PROJECT 952-A

The Highway passes through some of the roughest part of Western North Carolina and also one of the most beautiful sections. From Glennville to Tuckaseigee the road is never more than a few hundred feet from the river and the majority of it is located along the immediate bank. It passes very close to the famed Tuckaseigee Falls where the water plunges a hundred feet vertically and whose roar can be heard for miles. Above and below these falls are numerous other falls whose beauty is excelled only by that of the big falls.

This road opens up a section of Jackson County that has heretofore had only the roughest of mountain roads. No railroad traverses this section of the county, consequently all supplies have to be freighted in by wagons. This within itself was a big undertaking with the road that formerly existed. In winter the road was impassable for at least two months from East LaPorte to Glennville. During this period two mules could not negotiate the road with an empty wagon. Mail had to be carried on horseback. Aside from furnishing a long felt need to the natives of this section it also provides a shorter route to South Carolina and Georgia for the through traveller. Turning to the left at Sylva, by Cullowhee, Tuckaseigee, Glennville and on to Toxaway or Highlands, furnishes a much shorter route into the above named States than the route by Murphy.

The project, while only a graded road, presents serious difficulties both to the engineer and contractor. Even though no surface has been specified for this project the same methods are used for widening and super-elevating curves that obtain on hard-surface projects. This will save a great amount of work and re-surveying when the road is eventually surfaced.

Construction was started at Tuckaseigee at Station 560-04, the northern end of the project. This by reason of the fact that all materials, supplies, etc., have to be hauled from East LaPorte a distance of 3.5 miles. No local materials are used and the item of haulage is a big one. The contractors at first thought to begin work at both ends of the project, but upon investigation it was found that it would be necessary to haul all material and supplies for the Glennville end from Cullowhee, over the Cullowhee Mountain, a distance of ten miles. Consequently it was decided to begin work with two shovels at Tuckaseigee and haul all material from East LaPorte. The average haul is seven miles.

The first mile and a half presents no difficulties whatever because we have considerable latitude to work in, but at Station 493-00 the valley closes in to where it consists of the Tuckaseigee River only and from that station to the end of the project it is an almost vertical mountain side on one hand and the river on the other. The old mountain road, if it could be called a road, plays no part in the location or construction of the new, because it was laid off without regard to a minimum curve radius or length of tangent. On account of the topography of the country the work is extremely difficult for the construction forces. The old road is cut in innumerable places by the new and cannot be used for hauling. It is a hindrance rather than a help. The general position of the present road is below the old one and the grade from the new road to the old is prohibitive, in fact nothing short of a hoisting engine could make a wagon negotiate it. In view of the above facts it can be readily seen that the powder man and steam shovel are foremost on this project. All supplies and material have to be hauled after the shovel has built a road.

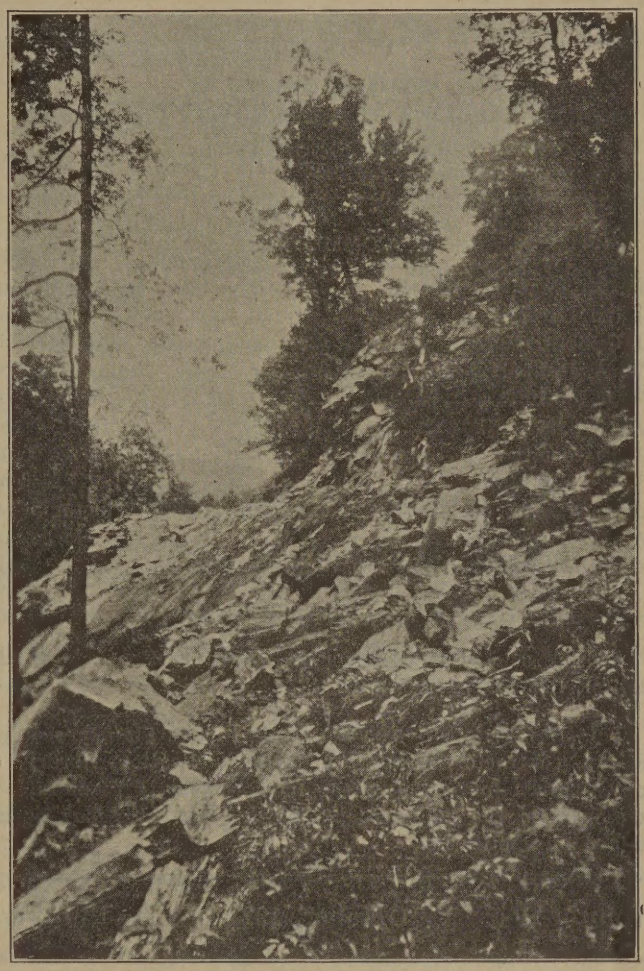
Heavy work is encountered on every hand. On account of the numerous ravines leading to the river from an almost vertical mountain side construction is very difficult, especially so when the ridges between the ravines are solid rock. Taking into consideration that the first mile and a half of the project was practically all common excavation and the fact that the project is only 31% finished, the monthly estimates to date show that 51% of the material moved has been rock. If we could waste these ridges they would present no difficulties because they could be blasted completely out, but all of it has to be saved for use in embankments. It is no uncommon thing to see a center-line stake marked "Cut 30.0" and not 50 feet away see one marked "Fill 40.0." The accompanying photographs give some idea of the rock encountered. Balancing quantities is a serious proposition. We have to be very careful of "Borrowing" because there is nothing to borrow but solid rock. Rock formations of all kinds abound. There have been days when two drills running ten hours could drill only nine feet while a few feet away the rock would be so soft that it could be churn-drilled. Most of the rock is seamed vertically which tends to "lead" the drills and cause no small amount of inconvenience. When shot it breaks into large pieces and has to be reshot before the shovel can handle it.

Despite the fact that there are numerous creeks and gorges there is not a bridge on the project. The original plans showed one of three 50-foot spans, 48 feet high, but this has been replaced with a fill and culvert. In the ten miles of road there are 24 culverts, mostly small but some very long ones, caused by high fills over them. No trouble is experienced in finding good foundation for these. In fact the trouble is in getting down to the desired elevation.

Pipe lines play an important part in the drainage of this project, there being over 6,000 feet of it. A vast majority of this is laid in solid rock. On account of the unusual slope of the natural ground installation of pipe lines is no simple matter. If the pipe is laid before the shovel makes a cut it necessitates cutting a ditch from four to twenty feet deep on the upper side of the road while if it is laid after the cut is made the ditch has to be sunk an equal amount through a fresh fill on the lower side. This matter has been remedied to a certain extent by laying the lower section of the pipe before the fill is made and the upper section after the shovel has made its cut. This eliminates the deep cutting but on account of certain difficulties cannot be used in every instance. It is no easy matter to handle a joint of reinforced concrete pipe weighing 950lb per joint on a slope of 60 degrees.

Another item, the cost of which has mounted to unthought of figures and one that usually presents no difficulties and no great amount of cost, is that of clearing. Practically all the trees on the right-of-way are unusually large and the slope of the ground is such that they can be cut in only direction. Couple this with the fact that the lower slope invariably runs within a few feet of the river bank and we have a situation that demands a lot of work not usually found in clearing. Two subcontractors have already tried it in the first four miles and given it up as a costly proposition.

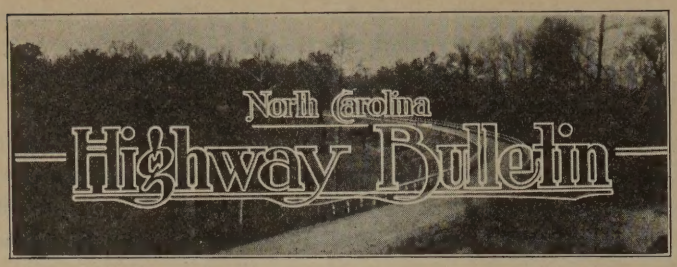
Practically all the slopes have to be "benched" or "stepped" before embankments are placed. The average natural slope of the ground is between 45 and 60 degrees from a horizontal and several instances nothing but bare rock. Due to the steepness of these and the nature of the material plowing is out of the question. This leaves only two methods, benching by hand or shooting. We use the latter method where there is no danger of fracturing the natural ground to the extent of producing a slide. Holes are drilled at such intervals and depths that when shot they form a continuous ditch or ditches, depending on the width and steepness of the slope. This is the most economical method and some instances the only method that can be used. We have had excessive rains on some of our embankments placed in this manner and have had no slides.



Scene on Project 952-A—Within 50 Feet of River and 100 Feet Above It

In view of the fact that the road passes through a very rough and mountainous section one would naturally look for an unusual amount of steep grades. However the road is so located that this is not the case. Very few steep grades occur. The total difference in

(Continued on page 13)



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Address all communications in regard to BULLETIN to the Editor, Box 1140, Raleigh, N. C.

This BULLETIN will be sent gratis to any State or county official, contractor, newspaper, trade publication, library, or other person interested in the improvement of roads and in the work of the Commission. Advertising rates may be obtained on application.

Volume IV **October, 1923** **Number 8**

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Editorial

The cover illustration this month is convincing evidence that all of North Carolina is not flat. It is on the highway from Topton to Robbinsville, the county seat of Graham County, one of the most difficult pieces of location and construction in the State. The resident engineer on this work describes it very interestingly on page 3.

—O—

The next letting of roadwork will be held on November 27th, when bids will be opened on two bridges, one overhead crossing and 130 miles of roadwork. Thirty-eight miles of the roadwork will be let for hard-surfacing, while the remainder will be let for grading and topsoil surfacing. As this is probably the last letting of the year a large number of bidders is expected.

—O—

The grade crossing problem is one which is constantly kept before us by the ever recurring accidents which take place daily. It is true that in every case the railroad is not to blame yet at the same time if there were no grade crossings there could be no grade crossing accidents and a large number of human lives would be saved each year. Mr. A. R. Losh, District Engineer with the United States Bureau of Public Roads, discusses the question in a very interesting and instructive manner on page 9.

—O—

The American Road Builders Association and Good Roads Show which is to be held in Chicago, January 14-19th, promises to be a success from every standpoint. Applications for space in the Coliseum have far exceeded the space available. This is the largest event of its kind and every one interested in highway work will find it well worth while to attend.

—O—

According to authentic data receipts from the tax on gasoline have exceeded $300,000 per month for the past six months, which goes to prove that there is a great deal of motor travel in the State. These funds are used primarily to maintain the roads and places the expense of maintenance on the man who uses them—where it properly belongs. At the present time tourists are paying about $500 per day toward this fund.

Contracts Let October 10th

A TOTAL of ninety-eight bids were received on the projects advertised for letting on the above date and all except two projects were awarded.

In the first district the Public Service Production Company of Newark, N. J., were successful bidders on Projects 126 and 187 which were let together. The contract calls for the construction of 12.15 miles of concrete road on Route 90 between Tarboro and Bethel. Type "F" concrete will be used as a pavement. The total cost of the work, including grading, drainage, and paving is estimated to be $460,000.00.

Project 302, the bridge over the Cape Fear River at Elizabethtown, was awarded to the Atlantic Bridge Company of Roanoke, Va., and the contract for 1.25 miles of grading to J. T. Plott of Greensboro. Plans have been revised and the contract calls for the construction of a steel bridge over the main channel, reinforced concrete approach spans on either end, and two creosoted timber overflow trestles. The work will cost in round figures $276,300.00.

Bids were rejected on Project 352, New Hanover-Brunswick counties. This work consists of hard-surfacing the causeway between Wilmington and Leland.

Project 404, Chatham County, has been changed to No. 404-A, inasmuch as it is a hard-surfaced project which is to be hard-surfaced later. This project consists of 11.25 miles on Route 53 between Pittsboro and the Lee County line and, as stated above, will only be graded at the present time, the contract for which was awarded to W. W. Tuck & Son, Virgilina, Va., while the contract for the structures was awarded to the Atlantic Bridge Company of Roanoke, Va., the estimated cost of the entire work being $141,295.00.

Project 485-B, Wake County, consisting of 7.81 miles of pavement on Route 50 from Neuse to the Franklin County line was awarded to R. G. Lassiter & Co., of Oxford, N. C. This includes the road through the town of Wake Forest, over which there has been considerable argument as to the route and unless some agreement is reached it is probable that this section will be omitted. Type "F" concrete pavement will be laid, the total estimated cost of construction being $271,000.00.

Project 537-A, Guilford County, a grading job was let to J. M. Gregory of Pittsboro, and the structures to C. B. Hester of Greensboro. The work is situated between Greensboro and the Randolph County line, a distance of 6.20 miles, on Route 70, and will cost in round figures $46,230.00.

The roadwork on Project 686, Stanly County, was not awarded but the structures were let to J. L. Brinkley & Son, Thomasville, N. C., for $52,561.00. This project is located on Route 27 between Albemarle and Charlotte.

Project 732, Davie County, has also been renumbered 732-A, as it will only be graded at the present preliminary to paving at a later date. The work is situated between Mocksville and Clemmons on Route 65 and is 8.07 miles in length. The contract for grading and structures was awarded to the J. F. Mulligan Construction Co., of N. Wilkesboro, N. C., the estimated cost of construction being $34,988.00.

The McDowell Contracting Company of Marion, N. C., was awarded the contract for the grading on Project 763, Surry County, 10.54 miles on Route 66 between Mt. Airy and Pilot Mountain, while the contract for the structures was let to C. A. Heilig, of Winston-Salem, N. C. The total estimated cost of construction is $164,973.00.

Bids were rejected on Projects 990-A-992, Transylvania County, 2.04 miles between Brevard and Lake Toxaway.

Charlotte-Statesville Highway Opened

WHEN Davidson College opened its Fall Session it was "quite a disappointment" to the students to learn that the mud holes they used to have to wade through from Davidson to Charlotte are a thing of the past. They will now find a complete ribbon of Black Top running the entire distance from Charlotte to Davidson. Project 653, Mecklenburg County, begins at the corporate limits of Charlotte, at the end of Statesville Avenue, running in a north-westerly direction for a distance of 8.85 miles. About 50% of this location follows the old road bed of the "old Statesville roadway"; the remainder of this project being new location —same following along the western side of the Southern Railroad between Charlotte and Statesville, and thus eliminating two dangerous grade crossings.

The contract for this project was awarded to Union Paving Company of Philadelphia, Pa., who in turn sublet the grading and base work to Speed-Parker Co., of Louisville, Ky. The base work on this project was not completed as rapidly as we had hoped for, due to labor conditions and on account of using a "Crusher-Run" local quarried stone for coarse aggregate. We found that in handling this stone it required from 50% to 60% more time and labor to get the progress that other projects were getting when using Bonsal gravel.

The Union Paving Company set up their asphalt plant at Croft, N. C., working first from northern end to project to plant and then from Charlotte city limits back to plant—this gave a maximum haul of five miles for asphalt trucks. When conditions are favorable the average run was 2,000 yds. per day.

Charlotte-Albemarle Highway

By F. H. TROLINGER, *Resident Engineer*

BEGINNING at the end of the Topeka pavement on Lawyer's Road about five miles east of Charlotte, Project 659, a section of the Charlotte-Albemarle-Raleigh Highway on Route 27, extends in a general easterly direction, approximately paralleling the Norfolk Southern Railway in its course through the towns of Wilgrove and Allen and ends at the Mecklenburg-Cabarrus County line.

This location follows the line of the old waterbound macadam for the first two miles then leaves the old road to avoid a grade crossing about half a mile beyond the town of Wilgrove where an underpass will be built. At Station 235 it again comes into the old macadam and follows this old grade to the end of the macadam at Station 300. From this point to the end of the project the location is new. This location is a decided improvement over the line of the old road, which besides being crooked and at times well nigh impassable, included several grade crossings, some of which were quite dangerous and all of which are eliminated by the new line.

Grading on this project was started early in April, 1923, and is now practically complete. All work in connection with the grading is being done by the Mecklenburg County convict forces under State Highway Commission's supervision. Very satisfactory results are being obtained and the slopes and ditches being all hand trimmed lend an unusually well finished appearance to the entire job. This appearance of finish, while largely due to care exercised on the part of the grading superintendent is partly due to the prevalence of a particularly fine class of red clay throughout the entire length of the project, the worst feature of which was a proper disposition of the stone in the old macadam. The drainage on this project is a very small item except that a large number of pipe culverts are necessary. The crossing streams are all small and no bridges needed. There are six reinforced concrete box culverts ranging in size from 3 x 3 to 12 x 12. The Luten Bridge Company of Knoxville, Tennessee, has the contract for these culverts and they should be completed within the next month. This job is to be a hard-surfaced road; the type not yet decided upon.

Project 659 has no distinctive or unusual features. Work is progressing satisfactorily and the grading and structures will be completed before the contract is let for surfacing.

At the end of Project 616, and forming another link in the Charlotte-Albemarle-Raleigh Highway, begins Project 616, extending through Cabarrus County, crossing Rocky River and the Stanly County line and extending on into Stanly County a few hundred feet to the beginning of Project 686, the total distance of the project being 8.595 miles.

Project 616 is unusual in that the location is almost entirely off the old road and no small towns directly along its route. It extends through and opens up some country which has hitherto been somewhat cut off from the State road system and which has no roads at all except the old dirt trails.

The location approximates a straight line and the long tangents, light curves and easy grades would become somewhat monotonous to the tourist passing through but for the fact that the project traverses a gently rolling and pleasing farming country, and what with passing from cultivated field to original growth forest, now corn or some other of a variety of crops, with here and there cattle grazing peacefully on the hillside, the traveller will ever find a pleasing view and a fresh surprise from the crest of every hill.

The grading on this project contains no considerable amount of rock. The drainage is easy and for the most part well defined. Numerous pipe culverts are needed but only four box culverts of any size were found necessary. The bridges consist of one 35-ft. clear span through girder type across Muddy Creek and one reinforced concrete deck girder bridge of ten 50-ft. clear spans across Rocky River. The contract for these structures was awarded to Lefler & Smith Construction Company of Albemarle, N. C. They have practically finished the culverts and have made unusually good progress on the two bridges. They expect to finish the contract by January 1, 1924. The Lee J. Smith Construction Company is doing the grading. They now have the rough grading practically complete over nearly six miles and have started putting on topsoil surfacing, a good quality of which is readily obtainable through almost the entire length of the job.

There are no unusual or remarkable features of this project except that the people all seem to be enthusiastic over the road and the men excavating for the foundations at Rocky River have found small quantities of gold. So far there are no signs of a gold rush except on pay days.

We hope to have the entire project completed by the first of the year and when linked up with Projects 659 and 686 will give an almost direct line to Albemarle and will very materially shorten the distance from Charlotte to Raleigh.

The Grade Crossing Problem

By A. R. LOSH, *U. S. District Engineer*

THE increasing rate of accidental deaths in the United States is a matter of grave concern. The annual toll is now more than 75,000 persons and in addition there are thousands injured and crippled to such an extent as to hamper them in their vocations and withdraw from them many of the pleasures of life —not by any means a credit to our civilization. When we examine the statistics we find that deaths from automobile accidents rank second highest, exceeding by 40 per cent the deaths from railroad accidents, which rank fourth. While the death rate from motor vehicles is increasing, in all fairness to the automobile user it must be said that the use of automobiles is increasing proportionately faster than is the rate of fatal accidents, that is, we had a less number of accidents per 1,000 cars in 1922 than we had in 1921. But with a death toll from the automobile of approximately 14,000 in 1922 we can obtain very little comfort from our decrease in accidents per car. We must consider the fact that the motor vehicle is now a transportation machine of universal use in the United States, there being one for every 8.7 persons. Furthermore, the use of motor vehicles will continue to increase from year to year and not only will there be more motor vehicles but with the extension of improved highways, there will be a greater economic field of usefulness for these machines.

I am not going to tell you that all automobile accidents or even a large part of them occur on railroad grade crossings but I know that we all agree on one point and that is, there are far too many accidents on rail on highway grade intersections. From the best information I can obtain it appears that there were 1,810 persons killed on railroad crossings in 1922, or about one-eighth of the total number of fatal automobile accidents for the year. The Texas Highway Commission in its latest report, places the number of persons killed on grade crossings in the State at about 100 per year.

On a 35 mile section of one of the State highways, 12 persons have been killed on grade crossings during the past two years. I know you are familiar with all this, much more so than I am perhaps, but my principal reason for making these references is to make it clear to you that we of the highway industry have this before us as one of our big problems to solve.

We must realize fully that the nature of our highway traffic has undergone a change revolutionary in character during the past ten years. From traffic studies made in Michigan it is shown that horse traffic has changed from 34% to 3.2%, automobile traffic from 62% to 87.6% and truck traffic from 4% to 9.2% in the interval of 1913 to 1922. An estimate on the statistics obtainable places the probable 1927 traffic as 1.5% horse traffic, 88.5% automobile traffic and 10% truck traffic. Not only will our highway traffic intensify and become heavier, but it will be of a more extensive character, that is, more over a large field, and individual drivers will not be familiar with all details of their courses. This presents a different problem than does the restricted local traffic which travels over a short course day after day and consequently knows all the points of danger.

The making of adequate provision for protecting this development in our transportation service is a responsibility we cannot disregard.

The work which the American Railway Association has done in the matter of public education to reduce grade crossing accidents is a most commendable one and one I am sure all thoughtful citizens of the country appreciate and hope to see continued. It is from this kind of work and from allied work among public officials in charge of roads and streets that we can hope for a substantial improvement in making it less hazardous for the travelling public. It should be remembered that both railway and highway traffic will continue to increase and unless we do take active and constructive steps in its educational work we may fully expect to see the grade crossing death rate increase by leaps and bounds. I have no figures on the number of grade crossings on the public highways and streets of the United States but I should say that 500,000 would be a conservative estimate, every one a potential source of danger. It must be apparent to everyone that we cannot hope to substantially reduce this number within the next twenty-five years, consequently it is a condition which we must meet and we should do so intelligently, forewarning the public of their danger and adopt all measures of safety which we can commend. We must concede at the onset that all grade crossings cannot be eliminated. They are a "necessary evil" which we must retain because we cannot assume the financial burden of their immediate elimination.

By this I do not mean that we should accept all grade crossings and cease our work on elimination, instead we should carry on this work more vigorously than in the past but with a definite working plan or program in view. Such a plan, however, is hardly possible without first of all a general concerted and coöperative action of highway and railroad executives and engineers. I know from personal contact with the State and Federal Highway Officials that the present death toll on railroad and highway intersections is a thing which weighs upon them and it is their policy to eliminate these points of danger

as rapidly as the funds at their command will permit. From my rather limited observations of railroad officials and from the campaign of education they have been conducting I see unmistakable evidence of similar feelings and desires on their part. I believe, therefore, that by a general meeting of the executives of these two branches of the transportation industry where this subject, in which there is a common interest, could be discussed in its entirety we could agree upon a plan of action which would correlate our efforts along one line, namely, reducing the railroad grade crossing hazard and accomplish results that are impossible of attainment under our present unorganized plan of operation.

I should like to present at this time some of the fundamental principles as I see them for a coöperative work between the railroad and highway interests in the matter of reducing the grade crossing hazard and to discuss the points in question briefly.

I. Consideration of the grade crossing problem of a State should be in its entirety and a State-wide plan determined based upon the existing conditions. A State agency, preferably the State Highway Department should determine the State plan in coöperation with the various railroads affected. The advantages of this, I believe, are obvious.

II. In any program adopted prior consideration should be given to those crossings which are most dangerous to the public and such crossings improved insofar as practicable in order of their relative importance.

III. A financial plan or yearly budget on the part of the State and the railroads would be desirable.

The States of Texas, Arkansas and Oklahoma discussed this plan last year and were agreed to a budget for a three-year period.

IV. Elimination of the grade crossing entirely be considered the desirable and preferable solution. Such elimination to be by the most economical method which will provide the desired ends. That is:

(a) By means of grade separation with the highway either above or below the railroad.

(b) By means of relocating the highway so that no crossing will be made.

(c) By means of relocating the railroad so as to avoid the crossing.

Frequently it is found very much cheaper to leave the railroad entirely undisturbed and relocate the highway. This can often be done for a distance of several miles and two crossings eliminated.

V. The permanent elimination of a grade crossing should be considered as an improvement or betterment to both the railroad and the highway and the cost thereof as an investment in the property. I believe grade crossing elimination should be looked upon as one of the permanent features of highway or railroad improvement, and classed with grade reduction and drainage as an engineering feature. The division of the cost for the separation should be the same without regard as to how it is made.

It is customary in many States to divide the cost between the highway and the railroad in constructing grade separations, but to leave the cost or relocation entirely upon the highway. There does not appear to be any good reason for considering the cost of relocation as beneficial only to the highway and assessing the entire cost against it.

VI. Where it is necessary to retain temporarily a grade crossing on new improvements provision for its future elimination should be provided if possible.

It is a very common condition where new improvements are being made to find that there are not sufficient funds to make relocations or provide grade separations immediately. Often traffic in the immediate future will not justify the expense, but where conditions are favorable, provisions should be made to eliminate the crossing when traffic demands it.

VII. At grade crossings when traffic is heavy, but due to physical conditions the cost of elimination is excessive, adequate provision for protecting the traffic be made by means of:

(a) Watchman with gates.

(b) Watchman without gates.

(c) Gates operated from central tower.

(d) Automatic signal devices.

I believe watchmen and gates are generally preferable to automatic signals for the reason that signals may not be heard or observed. Where automatic signals are used there should be a visible warning in addition to the usual bell. This is an important feature with the increasing use of closed cars.

VIII. As many grade crossings will be retained indefinitely as such due to their comparatively light traffic and their relative unimportance when considered with other crossings, provisions should be made to protect the public as far as possible by all practicable measures of warning and safety. This is our real problem, and the one which should receive our careful study. At this time I should like to consider somewhat in detail certain features of safety which have come to my attention, which I believe would greatly improve many of these crossings.

(a) Give clear unobstructed view of the crossing in both directions for approaching traffic. It is desirable to do clearing, remove or restrict buildings, remove spoil banks and otherwise clear the field of view for a distance of at least 250 feet from the railroad and 500 feet along the railroad. This would give the automobile driver when approaching the crossing, a view of the track for a distance of 500 feet and at a distance of 250 feet before he reaches it. This condition cannot

always be obtained and work of this kind will require the coöperation of municipal and county officials.

(b) The highway for a distance of 50 feet each side of the rails should be approximately level and beyond this limit approach grades should not exceed 5%.

(c) The roadway crossing itself should be smooth and not cause jar to passing vehicles.

(d) The highway and railway should cross as nearly as possible at right angles so as to give the best possible view of the railroad in both directions. Where the crossing is at a sharp angle the automobile user is compelled to look backward to obtain a view in one direction.

(e) The highway should be on a tangent or straightaway for at least 150 feet each side of the railroad. This is almost impossible to obtain in some cases but this is the desirable minimum.

(f) Standard warning signs should be set back from the railroad crossings 250 feet along the highway. These signs should be plainly warning signs without any advertising matter displayed. They should be uniform as to color, shape, and position on the road. No other signs resembling these should be allowed on the highways. A great deal of good would be accomplished in securing a standard warning sign so that travelers would learn to recognize it and would give it better attention than under the present nondescript methods. In this section of the country we do not have warning signs standard for an entire State even, and certainly we should have something that could be used almost universally for grade crossing warnings. In fact many of the grade crossings have no warning signs at all except the cross arm sign erected at the railroad right-of-way line.

The position of the warning sign is important. It should be sufficiently far from the crossing to give the operator on the highway warning in time to bring his machine under control, and it should be placed to attract his attention.

I believe a word should be said about a number of restrictive measures which have been advocated from time to time to control highway traffic over grade crossings. We have first to consider the construction of obstructions in the roadway which would cause traffic to slow down to a speed of ten to fifteen miles per hour just before crossing the railroad.

(a) Humps in the roadway is one plan suggested. This probably would have a fair measure of success if it were observed and all drivers reduced their speed to meet this condition. In my limited observation of this plan it has been found very unsatisfactory for the very natural reason that travelers unacquainted with the road speed over this construction and often from the resulting jar lose control of their car or throw the other parties up against the car top with painful and sometimes serious results. This was our experience on an Oklahoma road and after six months time public sentiment compelled the county officials to remove the obstructions.

(b) A dip or depression in the roadway is also suggested as a method of "speed control." I consider this in the same class as the hump construction, and in the light of our experience could not recommend it for general use on the highways. I believe the city of Memphis has a system of this kind on its park roads. It is my understanding from city officials that they consider it satisfactory for their park drives but are not using it elsewhere.

(c) The so-called "island" construction is perhaps less objectionable than the humps and dips since it will not in itself prove dangerous to traffic. This plan provides for an obstruction in the center of the road with warning signs at the approach to the railroad crossing. Traffic divides around this obstruction which is in effect an island in the traffic stream. It has the advantages of slowing down traffic and also giving the auto driver a view of the track in each direction before crossing. This plan has not been given extensive use to my knowledge.

(d) Legal restrictions or regulations have also been proposed and in some instances put into operation. I am informed that there is a Texas law limiting highway traffic to a speed of six miles per hour over grade crossings. It is common knowledge that no such regulation is observed. Stopping highway traffic at all grade crossings is another measure advocated, but it is inconceivable that it would meet with public approval. Measures of this nature for particular crossings may be made effective and are worthy of consideration. This certainly applies to vehicles on the highways operated as common carriers. Similar provision can also be considered for train operation which is limited and where the highway traffic is excessive. It is believed that on crossings where such measures are advisable, that watchmen and gates can be provided more economically than stopping traffic at all times.

RECORD PRODUCTION IN THE CEMENT INDUSTRY

ALL records for the production and shipment of portland cement were broken in August, according to figures recently issued by the U. S. Geological Survey. Production during August was 12,967,000 barrels, an increase of 350,000 barrels over July, the best previous record, and 1,300,000 over August last year. Production for eight months ending August 31, was nearly 88,000,000 barrels or more than was produced in any one of the entire years 1915, 1918 or 1919.

Shipments from the mills during August were only slightly under 15,000,000 or more than 600,000 barrels greater than in any previous month. Shipments for the first eight months of the year were nearly 91,000,000 barrels or more than 19 per cent greater than ever before.

Highway Work *in* Transylvania County

THE State Highway System in this county provides for a State Highway to cut through the county connecting the counties of Henderson and Jackson. Project 69 (Federal Aid) consists of ten miles of waterbound macadam beginning at the Henderson-Transylvania County line and extending to the corporate limits of Brevard, the county seat. This road completed during the present year, winds its way through the French Broad valley opening up the market for the agricultural products which provide the chief source of industry. It also provides an easy mode of travel for the vast tourist travel going to Brevard or points beyond, and has done much even during the present summer to boost business in Brevard.

Project 990, beginning at the outskirts of Brevard, extends to Rosman. This project is at present under construction, the grading being about complete. This contract provides for the surfacing of this ten miles of Route 28 with waterbound macadam, and when completed will connect the two most important towns in this county. The construction of the macadam will commence within the next week or ten days and from the equipment on the job it should be rushed to an early completion. In the location of this road especial attention was paid to the elimination of grade crossings, and so on the old road which had eight grade crossings in ten miles by the use of one overhead bridge and better location these grade crossings have been all eliminated.

Project 992 begins at the end of Project 991 and extends for two miles connecting Project 991 with a well graded road at present under construction by the county forces. The survey for this project is about complete and this location is also unique in the fact that it avoids excessive grades and eliminates two bridges and two grade crossings. This two miles parallels the French Broad River on its right and will entail some rather heavy work, as in spots the ground rises perpendicular from the river for a height of fifty feet. Beginning at the end of Project 992 and extending to the beginning of Project 991 is Project No. 1, Transylvania County. This road approximately nine miles long is being constructed by the Transylvania County Highway Commission. The location of this road almost entirely is over virgin land, and should be when completed one of the most picturesque roads in the State. This road is being built by the county 28 feet wide and with every curve widened it provides quite a change from the old road which was twelve feet wide. In different spots this road in rising through the mountains winds so that views can be had of different parts of the road, one above the other, from one spot—or to be more specific, if a rock was thrown down from the top it would touch the road three different times before reaching the bottom. This road also by relocation changes the grade of the old road which was on an average of eight per cent to one with an average of four per cent with a maximum of six per cent.

This road is at present about seventy-five per cent complete and should be complete at the latest by the next summer.

Project 991, beginning at Lake Toxaway and extending to Sapphire, provides for seven miles of grading, with bridges and culverts. This project will provide an outlet when completed, both for the heavy lumber operations above and also for an entrance to Lake Fairfield, a summer lake one mile above the end of this project. Fairfield Inn, the place where the Governor chose to spend a portion of his vacation, will be greatly benefited by the completion of this project as the present road to this place is one of the most tortuous winding roads in the State. The location and construction of this road is unique in the fact that it was necessary to cross Lake Toxaway at some point which would be most economical and at the same time best serve the public. The crossing made about two hundred feet below the dam site, and about a hunded feet above Toxaway Falls, will give a view unequaled. This road entirely leaves the present traveled road and skirts Toxaway Mountain at the same time cutting three miles from the present road and avoiding two crossings of the Horsepasture River. This project when completed will provide for an easy graded wide good aligned road from one end of the county to the other, and will provide a means for opening up the extensive timber resources along this route.

The One Road *to* Graham County

(Continued from page 3)

The only other approach to Graham County is through the gorge of the Little Tennessee River, from Tapoco—another rough piece of work. This is the proposed route to Knoxville.

From Robbinsville to Tapoco above the Talassee Power Company's water line will be about twenty miles.

At Tapoco is a reinforced concrete power dam about 220 feet high.

From Tapoco to Caldewood, Tennessee, is a rough stretch of ten miles for Tennessee to build. To connect with Knoxville thirteen miles of road will have to be improved from Caldewood toward Maryville.

To complete the eighty-eight miles of road from Topton to Knoxville, North Carolina will have to add twenty miles to Project 930, and Tennessee will have to build ten and improve thirteen miles of road.

That will make this, the prettiest part of these mountains, the summer resort for the Knoxville section. Tourists will bring more money into this section than will ever come any other way.

Projects 930 and 930-A will cost the State about $195,000. But this road has reclaimed Graham County—and is the first leg of the road to Knoxville.

Road Building *a* Big Business

ROADBUILDING belongs close to the top in the list of big businesses in the United States. The latest estimate compiled by Thos. H. MacDonald, Chief of the United States Bureau of Public Roads, shows that during 1923 approximately 40,000 miles of surfaced roads will be completed.

The 1922 construction program approximated 37,000 miles, divided as follows: 6,000 miles of pavement such as brick, concrete, sheet asphalt and bituminous concrete; 4,000 miles of macadam, waterbound and bituminous; 20,000 miles of gravel and 7,000 miles of sand-clay and topsoil roads. The classification of this year's 40,000 miles will be about the same.

At the beginning of this year, there were about 400,000 miles of improved surfaced roads in existence and at the present rate of progress, this mileage will be doubled in ten years.

One of the most important factors in the great movement for more and better roads which has resulted in the construction of improved highways at the rate of 40,000 miles a year, is the American Road Builders' Association which was organized more than twenty years ago, and which holds an annual convention and road show. The 1924 convention and show will be held in Chicago, the convention at the Congress Hotel and the show at the Coliseum from January 14th to 18th, inclusive.

The sessions of the convention will be open to men identified with and interested in highway work and will attract men from every part of the country. At the show in the Coliseum, all of the latest and approved appliances for road construction will be on exhibition. The officers of the Association are: President, Frank Page; Secretary, E. A. Birchland, and Treasurer, James H. MacDonald. The members of the Executive Committee are: Chairman, Frank Page; S. T. Henry, James H. MacDonald, Wm. R. Smith and T. J. Wasser.

The need for road construction at so rapid a rate as 40,000 or more miles a year is emphasized by Mr. MacDonald, who says that highway building should be continued as fast as the physical limitations of labor and material will permit. The longer the job is delayed, the greater will be the ultimate cost to the people. The reason is that the traffic on the main roads has now become so heavy that the excessive cost of operating motor vehicles over bad roads outweighs the cost of constructing good ones. Referring to one of the more heavily travelled roads of the country—the Boston Post Road from New York to Boston—Mr. MacDonald shows that if the road were a dirt road instead of a paved road, as it is, the greater cost of the motor truck traffic alone would pay for a paved surface in about eleven years. If the tremendous passenger car traffic were considered, the operating saving would pay the construction cost in a much shorter period.

To illustrate the pressing need for all possible speed in the improvement of roads, Mr. MacDonald cited the tremendous growth of motor vehicle registration. By July 1st of the year, the number of motor vehicles travelling the highways had increased to more than thirteen million, as compared with 1,711,339 in 1914. How directly the highway touches the lives of all the people is shown by the fact that there is now more than one motor vehicle for each 10 people. By just a little crowding the whole population could be taken for a ride at one time.

The Federal Aid Highway System, which will shortly be approved in its entirety, is indicative of the determination of the American people to have a highway system consistent with the demands of the traffic. The system will include nearly 180,000 miles of the most important roads of the United States, so located as to form a complete network of main interstate and inter-county roads. When completed, it will tie together practically every city and town of 5,000 population or greater, and a 10-mile zone on each side of the roads will include the home of 90 per cent of the people. To encourage the early completion of this system, all Federal appropriations will hereafter be spent only on roads which form a part of the system.

State Highway Project No. 952-"A"

(Continued from page 5)

elevation between the two ends of the project is 1,300 feet.

These are only a few of the interesting things about this project. Space will not allow us to do justice to all the unusual features about it.

There is no place in the State that could have been picked that needs a highway worse than this section and when the project, 952-B, from Tuckaseigee to Cullowhee is built connecting with the road already completed to Sylva, a first-class graded road will connect the above named towns and open for development a section that hasn't been scratched.

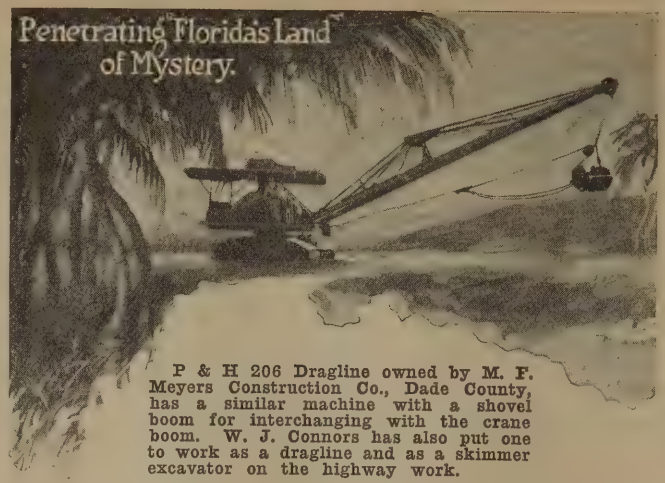
In conclusion let us say that if there is a project anywhere in this State that offers any more items of unhandiness and pure cussedness than this one we would like to see it.

Winston-Salem-Mocksville Highway

THE Project 741, or a part of the old highway which connects Winston-Salem and Mocksville, is worthy of special mention as an ideal road which every one can look upon as a great feat of construction, as well as engineering. The contract was let on the 20th of June, 1922, to The Hardaway Contracting Company, of Charlotte, N. C., and Columbus, Ga., and construction was started on the 25th of the following month. The first work, or Muddy Creek bridge, was started, and under many handicaps was finished in due time without any unusual happenings. The abutments, piers, slabs and handrails have been finished to such a fine point that even some of the official inspectors from the Raleigh office have gazed upon them and wondered if the bridge was whitewashed instead of being finished as it is. The handrails which naturally show up a bridge more than anything else, were poured one span length at a time on one day, and finished the following day. The forms were stripped about twelve hours after each handrail was poured, and by having a bunch of expert finishers with wooden floats and carborundum bricks on hand, we succeeded in making it one of the best bridges in the State of North Carolina. The culverts have been finished with equal care, and present a pleasing appearance to all.

The roadway from the first of November, 1922, until the first of March, 1923, was almost impassable, due to the fact that when the rough grading was done through and east of Clemmonsville the weather was very cold, and the heavy rains together with the heavy traffic to and from Clemmonsville as well as Davie County, made it impossible for the contractor to haul his materials to the mixer. As soon as this thoroughfare was barricaded, and all traffic was diverted to the State Maintained Detour, the fine-grade force was able to get the subgrade in such condition that when once the concrete force got started unusually good progress was made After reaching Muddy Creek Station, the concrete force was moved to a point half way between Muddy Creek Station and Atwood, where they again started another link that will be connected to the first link in a very few days.

With this much laid, and everything finished except the shoulders and headwalls of these two links, practically all pipe lines and rough grading finished on the entire project, we hope that the entire 8.9 miles will be finished not later than the first of December. As each succeeding link is laid, it will be laid with the view of using the previous links to haul over, thereby facilitating the immediate dispatch of the materials used in the construction of the roadway. The concrete, which has been cured and uncovered for traffic, presents a very pleasing view to every one. The vertical and horizontal curves show up especially well, also the super-elevated curves that are encountered. Those in authority, as well as those in the subordinate positions and places are striving to make Project 741 one of the best jobs in the western part of the State, as well as in the entire State Highway System.



P & H 206 Dragline owned by M. F. Meyers Construction Co., Dade County, has a similar machine with a shovel boom for interchanging with the crane boom. W. J. Connors has also put one to work as a dragline and as a skimmer excavator on the highway work.

In December the great Florida cross-state Connors' Highway will be a reality—running through the everglades where nearly a century ago Major Dade and one company of infantry were massacred by the Seminole Indians.

Threading the maze of the wilderness will no longer be impossible—intimate relationship between east and west coasts of Florida will be established.

Down in this remote part of the country dependable P & H Gasoline Draglines, Shovel and Skimmer Excavators have been doing their part in building this road from Okeechobee to Palm Beach.

The famous Corduroy Traction of P & H Excavators, the non-clogging, rugged construction—are of particular advantage when traveling over rough, uncertain ground. The heavy revolving structure keeps all shafts and machinery in permanent alignment; the hoisting and digging drums are on separate shafts; the full-floating fair-lead on the Dragline is mounted on the machine, resulting in center pull on ropes and long cable life. Ask for Bulletin 58-X.

P & H Draglines and Shovels are driven by powerful gasoline motors — ready for duty at the twist of the crank. Only one man required.



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STATUS OF STATE WORK IN NORTH CAROLINA

Projects Under Construction

NO.	COUNTY	LENGTH	TYPE	ESTIMATED COST	BEGUN	CONTRACTOR
101	Beaufort	4.23	P. C.	$ 145,492.76	1-20-23	Public Service Production Co.
105B	Beaufort	5.037	P. C.	164,301.61	1-19-23	Public Service Production Co.
106	Bertie	7.12	T. S.	58,204.90	9-11-22	J. F. Mulligan Constr. Co.—Boney & Hostetler.
107	Bertie	19.30	Graded	50,127.00	3-14-23	Nello Teer—Atlantic Bridge Co.
113B	Chowan	9.89	S. A.	100,000.00	4—9-23	State Forces.
115	Chowan-Perquimans	11.83	P. C.	326,304.00	5-15-23	Smith Brothers, Inc.
129	Edgecombe	8.10	Graded	40,850.00	9-14-22	State Forces.
131	Gates	15.95	T. S.	135,515.60	8-22-22	Bacon & Moore—W. D. Murray—Saddler Corp.
132	Gates	10.90	T. S.	63,921.00	8-29-22	J. A. Marrow.
133	Gates-Pasquotank	14.07	Gravel	138,045.77	1-17-22	C. W. Lacy—Pittsburg Des Moines Steel Co.
137	Halifax	5.95	Bit. Mac. and P. C.	180,441.92	11-21-21	O. F. Leighton—A. C. House.
138A	Halifax-Northampton	12.59	S. C.	131,712.13	5—1-22	Nello Teer—Richards Brothers.
138B	Northampton-Halifax		Bridge	347,188.74	2-28-23	Pensacola Shipbuilding Co.
141	Halifax Edgecombe	8.76	T. S.	220,679.58	8—8-23	J. P. Dicus—J. A. Peterson.
145	Hertford	112.88	Graded	88,161.42	7-31-22	Jamison & Bro., Atlantic Bridge Co.
146	Hertford-Bertie	6.42	T. S.	60,772.14	8—8-23	Nello Teer—Atlantic Bridge Co.
147	Hertford-Bertie	17.36	Graded	122,245.86	3—5-23	Nello Teer—Atlantic Bridge Co.
151	Hyde	4.30	T. S.	71,422.28	12-10-21	C. W. Lacy—Porter & Peck.
152	Hyde	10.89	S. C.	75,651.40	1-15-23	O. A. Mann & Co.
154	Martin	11.27	A. C.	394,153.29	4-17-22	Sou. Willite Paving Co.—O. F. Leighton, Inc.
154B	Martin	1.34	A. C.	37,690.00	8-27-23	State Forces.
155B	Martin	19.30	P. C.	493,900.40		W. T. Hadlow.
157A	Martin	12.41	W. B. Mac	85,822.00	10-18-22	Jamison Bros.—J. A. Marrow.
163 (F A 149)	Nash	14.96	P. C.	409,592.40	6-15-23	Public Service Production Co.
167 (F A 149)	Northampton	20.48	T. S.	92,444.11	7-17-22	Virginia Contracting Co.—Bacon & Moore.
168	Northampton	16.30	T. S.	107,229.87	8-27-23	Nello Teer.
173	Perquimans-Pasquotank	7.22	R. C.	239,444.70	8-25-22	Williams & Williams.
174	Pasquotank-Camden	2.40	Cord	55,818.01	4—3-22	D. E. Williams.
183A	Pitt	13.54	P. C.	390,854.40	11-13-22	S. J. Groves & Sons.
183B	Pitt		Bridge	32,343.30	3-27-22	B. J. Boyles.
184	Pitt	7.14	P. C.	206,516.42	11-31-22	Public Service Production Co.
185	Pitt	14.35	Graded	31,069.72	3-29-23	J. A. Marrow.
189	Pitt	5.30	P. C.	210,247.07	8—7-23	Smith Bros., Inc.—Pittsburg Des Moines SteelCo.
191	Tyrell	6.91	S. C.	58,594.41	1-20-22	C. W. Lacy—M. M. Jones.
195	Washington	15.18	S. C.	65,626.00	2-27-22	L. M. Lee—B. J. Boyles.
196	Washington	14.93	S. C.	83,632.78	5-15-22	W. N. Thompson.
200	Carteret	13.68	Graded	79,629.00	7-21-22	Eagle Engineering Co.—Batson-Cooke Co.
201	Carteret	14.14	Graded	81,652.62	1-17-23	Duplin Construction Co.—Batson-Cooke Co.
207	Craven	3.00	Gravel	10,000.00	7-27-23	State Forces.
208	Craven	4.50	Gravel	15,000.00	7-27-23	State Forces.
210	Craven	8.34	A. C.	292,698.06	4—3-22	West Construction Co.—A. P. Gilbert.
213 F A	Craven	10.43	A. C.	447,053.53	8—1-23	F. G. McGuire—Eagle Engineering Co.
219	Duplin-Lenoir	15.80	Graded	148,339.29	6—1-22	Chitwood & Carpenter.
220	Wayne-Duplin	14.53	A. C.	394,301.05	2-27-23	Union Paving Co.
236 (F A 143)	Johnson	14.83	A. C.	475,321.55	10—2-22	R. G. Lassiter & Co.
245	Jones	15.80	P. C.	265,179.53	3-22-22	Hyde & Baxter.
254	Lenoir		Bridge	73,415.32	11-22-22	Roanoke Iron and Bridge Co.
256	Lenoir		Bridges	57,680.00	1-11-23	Englehardt-Kuchen.
263	Pamlico	12.03	A. C.	289,324.20	3-27-22	Union Paving Co.
264	Craven-Pamlico		Bridge	27,156.25	7-24-22	Rhyne & Kitchen.
272	Sampson	16.47	Graded	98,807.39	6-19-22	R. E. Martin—Striblin-Standdy & Newell.
273	Sampson	2.44	P. C.	96,916.82	2-27-23	Eagle Engineering Co.
282	Wayne	14.22	A. C.	398,168.00	11-11-22	Union Paving Co.
291	Wilson	7.50	A. C.	203,493.18	1-17-22	P. R. Ashby.
291B	Wilson		Bridges	12,990.23	4—4-23	John M. Ogden & Co. (Road not let).
291C	Wilson	0.31	Grade	15,532.00		C. S. Wheeler.
294	Wilson		Bridge	15,770.80	11-29-22	Stearns Brothers.
295	Wilson	9.92	Recon.	124,060.64	8-20-23	Highway Engineering and Construction Co.
312	Brunswick	9.77	P. C.	347,319.68	7—5-22	Alabama Con. Prod. Co.—Batson-Cooke Co.
314	Brunswick	15.82	S. C.	109,259.10	2-23-22	Hagedorn Construction Co.
316	Brunswick	12.12	S. C.	80,068.72	8-14-22	B. Frank Price—Batson-Cooke Co.
326	Columbus	13.61	S. C.	195,838.19	5-23-22	J. T. Plott—J. A. Kreis & Co.
327	Columbus	5.2	S. C.	38,269.44	6-21-22	J. A. Kreis
328	Columbus	7.03	P. C.	219,371.68	12-26-22	L. L. Tindall.
340	Cumberland	11.07	P. C.	381,032.02	6-15-22	Alabama Concrete Prod. Co.-Hobbs & Peabody.
342	Cumberland	5.91	A. C.	177,402.50	10-30-22	A. J. Wardrep.
351	New Hanover	10.64	A. C.	189,540.00	1—8-23	Southern Willite Paving Co.
363	Onslow	15.24	T. S.	208,476.95	3—5-23	Newell Constr. Co.—Pittsburg Des Moines Steel Co.
364B	Onslow	12.84	T. S.	99,819.50	6-26-22	A. W. McClay.
366	Onslow	18.5	S. A.	200,000.00	6-15-23	State Forces.
378	Pender	14.12	W. B. Mac	213,502.96	7-19-22	C. W. Lacy.

STATUS OF STATE WORK IN NORTH CAROLINA---*Continued*

Projects Under Construction (Continued)

NO.	COUNTY	LENGTH	TYPE	ESTIMATED COST	BEGUN	CONTRACTOR
380	Pender	8.98	W. B. Mac	162,212.60	3—6-23	C. W. Lacy.
382	Pender	5.60	S. A.	60,000.00	4-25-23	State Forces.
386 (FA 140) 387	Robeson	19.80	P. C.	647,888.05	9—4-22	Jas. O. Heyworth.
389	Robeson-Columbus	1.56	T. S.	83,463.38	10-26-21	L. A. Chitwood
391B	Robeson	1.10	T. S.	17.433.00	2-26-23	H. M. Beasley.
392	Robeson	1.06	T. S.	85,049.91	5—1-23	Robeson County Com.—E. T. Gwathmey.
402	Chatham	6.92	T. S.	33,940.28	8—1-22	W. N. Thompson.
403	Chatham	7.01	Gravel	66,814.00	2-17-23	C. G. Kershaw.
408	Durham	0.47	S. A.	4,820.00	6—7-23	Murray Construction Co.
412	Durham	8.80	P. C.	252,582.00	11-15-22	L. L. Tindall.
419	Franklin	12.82	T. S.	63,021.97	7-27-22	Jamison & Bro.—J. M. Gregory.
428	Granville	4.19	R. C.	142,637.77	7-14-22	Pittman Construction Co.
429	Granville	6.94	P. C.	261,397.29	3-21-23	R. B. Sandidge.
437	Harnett	10.74	Gravel	101,031.26	5—8-23	F. P. Holden—T. J. Newell.
438	Harnett	3.82	P. C.	158,316.57	7-16-23	J. M. Gregory—T. J. Newell.
446	Lee	5.05	A. C.	209,090.00	5-24-22	Atlantic Bitulithic Co.—O. A. Mann.
456	Orange	9.81	Graded	37,459.07	1—7-22	Crawford & Crawford—Nello Teer.
457A	Orange	7.45	Graded	75,398.67	4-12-23	Dicus Bros.—Richards Bros.
460	Orange	9.87	A. C.	296,835.55	9-25-22	R. M. Hudson & Co.
463	Person	11.24	P. C.	327,171.35	8-14-22	Porter & Boyd.
464	Person	11.58	T. S.	85,179.27	8-13-23	Micheaux Construction Co.
473 (FA 146)	Vance	7.83	P. C.	265,546.60	7-11-22	R. G. Lassiter & Co.
481	Wake	7.40	A. C.	254,995.34	1-24-22	Union Paving Co.—P. R. Ashby Co.
484	Wake	8.79	P. C.	311,590.40	8-23-22	P. R. Ashby—Booz-Lloyd & Co.
484B	Wake		Bridge	13,112.99	7—2-23	Booz-Boyd.
485A	Wake	7.35	Graded	92,818.00	5—4-23	C. G. Kershaw Constr. Co.—T. J. Newell.
486	Wake	9.04	T. S.	41.074.00	4-11-23	O. A. Mann & Co.
492	Warren	4.48	Bit. Mac.	100,436.13	4-10-22	Porter & Peck—A. C. House.
493	Warren	3.39	Bit. Mac.	77,866.80	7-27-22	Porter & Peck.
494 (FA 147)	Warren	6.21	A. C.	208,130.01	9—6-22	Clifford Engineering Co.
495	Warren	7.81	T. S.	71,122.15	9-18-23	J. A. Marrow.
511	Caswell	14.80	T. S.	73,242.18	12-12-21	White & Simpson—C. B. Hester.
512	Caswell	11.67	T. S.	54,375.53	2-19-23	J. T. Plott.
522	Davidson	1.00	P. C.	37,856.50	6-29-23	Hagedorn Construction Co.
528	Davidson	10.24	P. C.	427,511.92	10—2-22	Hagedorn Constr. Co.—J. A. Peterson.
532	Guilford	11.70	A. C.	385,957.88	2—1-22	Eliot & Sholes & Co.
532B	Guilford		Bridges	24,730.00	1—5-23	L. M. Lowdermilk.
532C	Guilford	0.50	P. C.	12,650.00	2—1-22	W. B. Kiker.
535	Guilford	7.78	R. C.	290,605.21	4-19-22	Leaksville Lumber Co.
541	Guilford	4.31	Bit. Mac.	119,469.24	8-15-23	Hagedorn Construction Co.
545	Hoke	9.15	T. S.	58,195.06	6—5-22	O. A. Mann & Co.—A. W. McClay.
555	Montgomery	20.55	T. S.	103,703.38	2-19-23	Mayfield Construction Co.—F. P. Holder.
556	Montgomery	3.07	Bit. Mac.	78,704.00	9—4-23	J. F. Mulligan Construction Co.
569	Moore	18.97	S. C.	97,151.45	8—1-22	Mayfield Construction Co.
570	Moore	22.52	T. S.	89,804.33	5-22-23	A. B. McDonald.
577	Randolph	13.77	P. C.	422,343.57	4-18-22	Royer, Ferguson & Co., Inc.—J. L. Brinkley.
578 (FA 156)	Randolph	7.97	P. C.	312,662.68	5-10-23	Allport Construction Corporation.
588	Rockingham	7.98	R. C.	266,498.43	4-11-22	Cheatwood & Driscoll.
589	Rockingham	9.81	P. C.	324,975.31	10-30-22	Cheatwood & Driscoll—Atlantic Bridge Co.
590	Rockingham	2.10	P. C.	66,092.18	6-15-23	Geo. R. Martin.
602	Alexander	9.28	Bit. Mac.	189,329.80	10—9-22	W. E. Graham.
608	Anson	7.85	A. C.	345,408.58	9-27-22	Lampton & Burks—J. A. Peterson.
608B	Anson	3.83	Grading	44,224.10	7-20-23	Ben F. Teeter—J. A. Peterson.
614 (FA 144) 615	Cabarrus	9.20	P. C.	353,590.00	7-21-22	A. L. Harris—Oliver & Costello Brothers.
	Cabarrus	3.88	A. C.	98,741.17	3—9-23	Thompson-Caldwell—Atlantic Bridge Co.
616	Cabarrus	8.59	T. S.	46,024.00	4-11-23	Lee J. Smith—L. M. Lefler & Smith.
622	Catawba	10.85	A. C.	353,590.00	1-23-22	Union Paving Co.
629	Catawba	7.52	P. C.	268.662.48	6—5-22	A. L. Harris—R. M. Thurmond & Co.
630B	Gaston	6.65	A. C.	218,625.00	8—8-22	W. F. McCanless, Hobbs-Peabody Constr. Co.
632	Gaston	8.50	R. C.	291,868.94	1—2-22	Davis-Wilcox Construction Co.
633B	Gaston	3.37	A. C.	57,247.41	1-16-23	Gaston County.
639	Iredell	10.59	A. C.	387,346.19	1—2-22	R. M. Hudson Co.—Luten Bridge Co.
640	Iredell	8.17	Bit. Mac.	181,990.82	9-26-22	W. E. Graham.
643 (FA 157)	Iredell	8.57	A. C.	321,614.81	5-21-23	Stearns Brothers.
647	Lincoln	7.10	P. C.	250,108.15	6—5-22	A. L. Harris—R. M. Thurmond & Co.
653	Mecklenburg	8.84	A. C.	308,732.43	2-28-22	Union Paving Co.—Luten Bridge Co.
654	Mecklenburg	10.10	A. C.	302,887.09	4—3-22	Lampton & Burks.
658 (FA 145)	Mecklenburg	9.55	A. C.	266,758.80	10—9-22	Union Paving Co.
659	Mecklenburg	7.93	Graded	36,650.00	4—9-23	County Commissioners—Luten Bridge Co.
661	Richmond	9.76	T. S.	40,683.41	7-18-22	McDonald & Brooks.
665	Richmond	5.77	A. C.	194,501.23	7-28-22	A. J. Wardrep.
670	Cabarrus-Rowan	4.53	P. C.	142,221.53	6-29-22	Harris Construction Co.
671	Rowan	7.43	A. C.	309,262.14	3-20-23	Thompson-Caldwell Constr. Co.—Atlantic Bridge Co.
673	Davidson-Rowan	.59	Bridge	221,353.00	9-19-22	Hardaway Contr. Co.—Elliot & Sons.
677	Scotland-Robeson	7.11	R. & P. C.	283,460.61	4-26-22	P. R. Ashby—J. B. Murphy.

STATUS OF STATE WORK IN NORTH CAROLINA---*Continued*

Projects Under Construction (Continued)

NO.	COUNTY	LENGTH	TYPE	ESTIMATED COST	BEGUN	CONTRACTOR
679	Scotland		Bridges	29,570.00	7—1-23	P. R. Ashby.
691	Union		Bridge	14,520.00	2-13-23	J. S. Brinkley.
694	Union		Bridge	23,549.13	11—4-22	Hagedorn Construction Co.
696	Union	6.05	A. C.	139,901.30	3-10-23	Redmon Construction Co.
700	Alleghany	7.90	W. B. Mac	132,297.33	6-23-21	W. E. Graham.
701	Alleghany-Wilkes	8.00	W. B. Mac	166,245.20	6-16-21	W. E. Graham.
702A	Alleghany	7.75	B. M. & Gravel	209,188.98	10-31-22	O'Brien Constr. Co.—Luten Bridge Co.
702B	Alleghany	6.49	Gravel	191,737.26	8—6-23	Turner-Hartsoe—Luten Bridge Co.
711	Ashe	6.50	Gravel	60,000.00	9—7-22	Little Contracting Co.
712	Ashe	11.06	Gravel	197,687.38	10-24-22	J. T. Plott.
713 (FA 139)	Ashe	3.53	P. C.	166,595.00	8-22-22	Overstreet & Nance—Concrete Steel Bridge Co.
726 726A	Caldwell	11.00	Gravel	50,000.00	5—5-23	State Forces J. F. Mulligan Construction Co.
741	Forsyth	8.90	P. & R. C.	315,025.81	7-27-22	Hardaway Construction Co.
742 (FA 137)	Forsyth	10.62	R. C.	413,067.27	7-20-22	Harris Construction Co.
743	Forsyth	11.35	A. C.	414,085.43	4—2-23	Atlantic Bitulithic Co.
750	Stokes	14.86	T. S.	93,054.48	9-15-21	J. F. Mulligan Constr. Co.—Lee J. Smith.
752	Stokes	9.67	T. S.	124,874.75	2-17-23	W. E. Graham.
761	Surry	2.22	P. C.	77,334.01	11-22-22	Geo. R. Martin.
765	Surry	3.40	P. C.	112,685.76	10—2-22	Campbell Construction Co.
770A	Wautauga	3.00	Bit. Mac.	40,000.00	8-12-22	State Forces.
770B	Wautauga	8.90	Gravel	93,500.00	4-16-23	State Forces.
771A	Wautauga	2.50	Bit. Mac.	30,000.00	9—7-22	State Forces.
771B	Wautauga	13.50	Gravel	35,000.00	9—7-22	State Forces.
780	Wilkes	7.83	Recon.	25,000.00	11-25-21	J. F. Mulligan—State Forces.
781	Wilkes	14.50	Recon.	154,000.00	8—8-21	J. F. Mulligan—State Forces.
784	Wilkes	4.97	T. S.	85,966.21	9-27-22	J. F. Mulligan Constr. Co.—Foster Constr. Co.
790	Yadkin	10.12	P. C.	330,254.27	4-24-22	Pittman Construction Co.
800	Avery	5.84	Gravel & R. C.	198,827.02	7-31-22	O'Brien Constr Co.—J. A. Kreis.
802	Avery	5.68	Graded	98,043.44	7-30-23	Hughes & Rae.
811	Burke	5.24	P. C.	185,132.97	1-13-22	Southern Dray Co.
811B	Burke		Bridge	16,013.80	8-10-23	R. W. Curtis.
812A	Burke	4.89	Grading	58,629.01	7—6-23	M. A. Kolloch—Padgett & Justice.
815	Burke-Cleveland-Lincoln	11.63	T. S.	153,126.60	3-20-23	Geer & Wilson—J. L. Von Glahn.
821	Cleveland	1.58	P. C.	60,192.33	10-31-22	Davis-Wilcox Construction Co.
822 (FA 150)	Cleveland	10.47	A. C.	404,444.48	9-27-22	Elliot & Sons—J. A. Kreis & Co.
833	Henderson	5.20	Gravel	34,952.94	1—3-22	S. L. Davis Constr. Co.—Asheville Constr. Co.
835	Henderson	6.82	W. B. Mac	286,019.91	9—9-23	J. B. Ross, Jr.—R. C. Stevens.
836A	Henderson	9.10	Grading	168,630.00	7-13-23	J. B. Hawkins—J. L. Von Glahn & Co.
846	McDowell	10.06	Gravel	204,680.74	9-22-21	Asheville Constr. Co.—W. T. Taylor Constr. Co
847	McDowell	3.84	Graded	91,217.50	10-19-22	C. W. Lacy—Oliver & Costello Brothers.
848	McDowell		Bridge	18,597.04	11-21-22	R. M. Thurmond & Co.
856	Mitchell	6.88	Bit. Mac.	239,343.83	3-20-22	Porter & Boyd—L. J. Chandler & Co.
858	Mitchell		Bridge	42,367.49	10—2-22	R. M. Thurmond & Co.
860	Mitchell	5.58	W. B. Mac	152,922.00	4-30-22	J. F. Mulligan Constr. Co.—W. H. Anderson Constr. Co.
866	Polk	5.96	Bit. Mac.	180,393.40	11-21-11	Southern Paving Co.—Henry Constr. Co.
876 (FA 78B)	Rutherford	4.80	P. C.	146,264.80	10-30-22	Fisk-Carter Construction Co.
882	Rutherford	15.80	T. S.	94,666.00	9-20-22	C. R. Willard & Sons.
882B	Rutherford		Bridge	10,582.00	5—3-23	Micheaux Construction Co.
888	Yancey	15.22	W. B. Mac	230,499.94	10-10-22	The Luck Co.
901 (FA 148)	Buncombe	7.52	P. C.	354,082.45	11—6-22	R. C. Stevens—A. J. Wardrep.
903	Buncombe	2.58	A. C.	100,399.47	4-10-22	Asheville Paving Co.—R. C. Stevens.
911	Cherokee	10.33	Gravel	144,991.44	10-25-21	H. A. Wells—Southern Dray Co.
913	Cherokee	10.33	W. B. Mac	95,554.80	8—8-22	Mills-Williams Construction Co.
920	Clay	5.01	Gravel	50,716.66	1—9-22	E. A. Wilson & Co.—W. T. Moore Conc Prod Co.
921	Clay	12.37	Gravel	99,988.02	10-24-21	Lee J. Smith Constr. Co.—W. T. Moore Conc. Products Co.
930	Graham	12.90	Gravel	143,574.20	10-15-21	Lee J. Smith Constr. Co.—C. M. Dicus.
940	Haywood	7.13	W. B. Mac	126,069.30	4-14-22	Alexander & Patton—H. A. Brown & Co.
944 (FA 16)	Haywood	10.18	A. C.	410,068.45	5-14-23	A. J. Wardrep.
950	Jackson	7.56	Gravel	145,313.30	6-13-21	Wright & Nave—O'Brien Constr. Co.
951	Jackson	11.58	W. B. Mac	249,546.00	8-17-22	R. H. Wright & Sons—W. T. Moore Conc. Prod. Co.
952A	Jackson	10.35	Graded	164,126.60	8-17-22	Brooks-Calloway Co.
953	Jackson	12.72	Graded	118,186.75	7—1-22	C. C. McCabe.
954	Jackson	1.68	P. C.	90,871.77	7—1-22	Mills-Williams Construction Co.
960	Macon	4.97	S. C.	69,100.57	6—6-21	J. T. Plott—J. E. Lane & Co.
961	Macon	4.77	T. S.	58,340.59	12-5-21	J. T. Plott—J. E. Lane & Co.
962	Macon	13.58	W. B. Mac	171,200.05	4-24-22	O'Brien Constr. Co.—Griffin Constr. Co.
963	Macon	8.68	Graded	124,354.01	11-10-22	Costello Bros.—Brooks-Calloway Co.
970	Madison-Yancey	13.80	W. B. Mac	218,940.17	11-11-21	R. H. Wright & Sons—O'Brien Constr. Co.
971	Madison	6.74	Gravel	183,090.38	4-23-23	Reynolds Constr Co.—Moore Conc. Prod. Co.
972	Madison	6.60	Grading	50,000.00	4—6-23	State Forces—C. M. Dicus.
980	Macon-Swain	17.84	W. B. Mac	350,175.11	3-20-22	Costello Bros.—Condon & Condon.
990	Transylvania	8.87	W. B. Mac	151,238.89	6—5-22	Sam L. Davis Constr. Co.—R. C. Stevens.
991	Transylvania	7.03	Graded	156,653.20	3—6-23	Gibson Construction Co.

STATUS OF STATE WORK IN NORTH CAROLINA---*Continued*

Projects Completed

NO.	COUNTY	LENGTH	TYPE	APPROXIMATE COST	COMPLETED	CONTRACTOR
100	Beaufort	10.50	R. C.	$ 369,777.70	3-15-23	W. T. Hadlow
103	Beaufort	.03	R. C.	1,706.75	7—3-22	R. G. Lassiter.
105A	Beaufort	2.00	P. C.	78,839.42	7-16-23	J. L. McGhee Contracting Co.
110	Camden	2.71	R. C.	134,866.48	7-20-23	State Forces.
113	Chowan	10.32	Graded	39,743.33	3—1-23	Nello Teer—Gregory & Talbot.
114	Chowan	10.40	Graded	45,064.09	4-14-23	Battershill & Goode—Chandler & Ragland.
125	Edgecombe	15.11	A. C.	426,438.76	4-23-23	R. G. Lassiter.
139	Halifax	.....	Bridge	*20,425.59	8-25-22	Chandler & Ragland—Porter & Peck
140	Halifax	.....	Bridge	*11,043.05	5—5-22	Von Glahn & Talbott.
159	Nash	11.22	T. S.	89.942.43	7-30-23	J. A. Kreis & Co.
160	Frklin.-Wake-Nash	8.93	T. S.	53,722.95	3—7-23	Chandler & Ragland—Southern Dray Co.
166	Northampton	.47	Bridge	17,954.75	9-14-22	W. D. Murrey—Sadler Corp.
175	Pasquotank	9.50	Brick	217,405.72	4-19-23	County Commissioners.
186	Pitt	9.57	R. C.	*248,103.78	8—5-22	Cheatwood & Driscoll.
209	Craven	2.65	P. & R. C.	*114,569.02	1-28-22	Eagle Engineering Co.
211	Craven	9.93	A. C.	288,946.02	5-16-23	Union Paving Co.
218	Wayne-Duplin	16.06	Graded	*97,186.30	2-24-23	C. W. Lacy
227	Greene	6.81	A. C.	239,797.80	1-25-23	West Construction Co.—Union Paving Co.
255	Lenoir	0.82	S. A.	*30,384.89	8-18-22	West Construction Co.
275	Sampson	-----	Bridges	8,769.74	8-22-23	Rhyne & Kitchen.
280	Wayne	10.01	A. C.	311,352.36	5-12-23	Union Paving Co.
281	Wayne	.....	Bridge	*21,225.49	1-15-23	P. R. Ashby.
300	Bladen	11.99	S. C.	64,911.71	6-16-23	T. W. Chandler—Nello Teer.
301	Bladen	13.17	T. S.	82,028.21	2-20-23	J. F. Mulligan—Powell Paving and Constr. Co.
325	Columbus	11.22	T. S.	105,530.04	7-14-23	J. A. Kreis—Cornell & Young & Co.
338	Cumb.-Sampson	.....	Bridge	*29,223.84	9-26-22	Roanoke Bridge & Iron Works.
339	Harnett-Cumb	.754	T. S.	*21,031.64	8-31-22	Porter & Boyd
341	Cumb -Hoke	.2	Graded	*1,042.55	2-28-22	W. B. Covington
375	Pender	13.56	S. C.	68,830.09	11-21-22	A. W. McClay
388	Robeson	3.35	R. C.	137,009.40	9-28-22	C. W. Lacy—Roanoke Bridge & Iron Co.
400	Chatham	.....	Bridge	57,420.22	5-18-23	R. M. Walker & Co.
400A	Chatham	.....	Grading	5,400.00	8-27-23	C. B. Hester.
409	Durham	0.5	Graded	*5,409.10	8—7-22	J. P. Dicus.
410	Durham	2.3	R. C.	*81,105.75	9-28-22	C. D. Riggsbee.
411	Durham	5.81	P. C.	211,574.92	7-12-23	Hutton Engineering and Construction Co.
420	Franklin	1.56	R. C.	55,421.30	5-29-23	Chandler & Ragland.
427	Granville	5.12	A. C.	178,257.64	1—4-23	R. G. Lassiter & Co.
436	Harnett	21.91	Gravel	202,563.88	1-15-23	C. G. Kershaw Const. Co.—Hobbs & Kitchen.
445	Lee	5.91	T. S.	18,692.85	1-15-23	C. B. Hester.
453	Orange	.....	Bridge	33,706.80	1—9-23	Geo. W. Kane.
454	Orange	4.28	P. C.	197,675.32	3—6-22	Elliott, Sholes & Teer.
455	Orange	4.19	T. S.	*55,214.44	9-28-22	J. F. Mulligan Const. Co.—P. R. Ashby.
481	Wake	7.40	A. C.	254,995.34	----------	Union Paving Co.—P. R. Ashby.
482	Wake	6.64	A. C.	*184,393.31	9-23-22	R. M. Hudson Company.
483	Wake	0.54	R. C.	*15,630.74	8--7-22	C. D. Riggsbee.
485C	Wake	0.50	Grade	10,613.90	7-31-23	Booz-Boyd---Nello Teer.
500	Alamance	5.22	Graded	*36,844.34	1-17-22	W. W. Tuck & Son—A. M. Hazell, Connerate—Quist Construction Co.
501	Alamance	13.1	T. S.	30,927.27	2-28-23	W. M. Shook-Hanford Bros.
502	Alamance	17.43	T.S.&B.M.	138,629.97	9-13-23	W. E. Graham—Hanford Brothers.
503	Alamance	.....	Bridge	59,450.38	7-20-23	Atlantic Bridge Co.
504	Alamance	5.22	A. C.	154,127.16	5—3-23	Elliot & Sholes.
505	Alamance	0.42	S. A	*15,229.74	6-23-22	Hedrick Construction Co.
506A	Alamance	0.32	Grade	8,866.45	8-11-23	Nello Teer.
524	Davidson	0.3	S. A.	*9,941.54	1-20-22	Town of Lexington.
525	Davidson	10.24	A. C.	363,850.08	9—4-23	Elliot & Sons & Boggs—Austin Bros. Bridge Co.
525A	Davidson	.5	S. A.	*16,419.86	6-27-21	Town of Lexington.
526	Davidson	3.77	P. C.	*131,269.66	10-25-22	Hagedorn Constr. Co.—Heilig & Sherrill.
533	Guilford-Forsyth	10.59	P. C.	427,997.62	7-23-23	Royer-Ferguson Construction Co.
538	Guilford	.....	Bridge	7,039.01	2-21-23	J. L. Brinkley.
539	Guilford	0.64	S. A.	21,639.20	1-19-23	Robt. G. Lassiter & Co.
540	Guilford	18.00	Recon.	16,527.54	1-23-22	J. T. Plott.
544	Hoke	10.45	S. C.	32,445.49	5—3-23	O. A. Mann & Co.—Chitwood & Carpenter.
546	Hoke	0.84	S. A.	27,949.00	5-30-23	Dawkins Construction Co.
566	Moore	7.14	T. S.	62,079.21	6-30-23	Gibson Construction Co.—Nello Teer.
567	Moore	2.96	T. S.	*9,967.53	9-18-22	C. E. Teague.
593	Rockingham-Caswell	17.98	P. C.	552,393.22	8-18-23	J. A. Kreis.
600	Alexander	9.30	Graded	12,530.98	4-14-23	Bolton Construction Co.
601	Alexander	3.07	T. S.	33,630.45	3-31-23	Guss Ginn-R. M. Thurmond
606	Stanley-Anson	.....	Bridge	55,802.03	6—6-23	Concrete Steel Bridge Co.
607	Anson	6.93	T. S.	41,324.35	5-17-23	Geer & Wilson—Booz-Lloyd & Co.
630A	Gaston	3.02	A. C.	*98,854.41	7- -22	W. F. McCanless.
633A	Gaston	13.77	A C.	57,247.41	10-5-22	Gaston County
634	Gaston	Bridge	Recon.	*4,344.00	.....	State Forces.
638	Iredell	7.88	A. C.	262,142.65	1-20-23	Thompson-Caldwell Co.
652	Mecklenburg	.....	Bridge	1,923.28	10-30-22	State Forces.
655	Mecklenburg	1.57	P. C.	51,658.44	7-31-22	Speed-Parker Co., Inc.—Luten Bridge Co.
656	Mecklenburg	10.4	Bit.-Mac.	7,198.07	10-30-22	State Forces.

(*Final Cost)

STATUS OF STATE WORK IN NORTH CAROLINA---*Continued*

Projects Completed—Continued

NO.	COUNTY	LENGTH	TYPE	ESTIMATED COST	COMPLETED	CONTRACTOR
657	Mecklenburg	13.80	Recon.	$ 15,961.02	10-30-22	State Forces.
692	Union	2.28	A. C.	*65,279.20	12-28-21	Redmon Construction Co.
693	Union	1.14	T. S.	3,324.48	2-23-23	Sykes-Collins Co.
695	Union	4.51	A. C.	*138,738.07	9-14-22	Redmon Construction Co.
710	Ashe	3.14	P. C.	*142,707.93	8-17-22	Pittman Construction Co.
719	Caldwell	.....	Bridge	*7,906.87	9-19-22	Cottrell & Howard.
719B	Caldwell	.99	Gravel	*1,235.33	11-15-22	J. G. Bumgardner
722	Caldwell	7.40	Recon	*20,923.25	1-18-22	County Forces.
724	Caldwell	4.66	T. S.	51,890.66	7-24-23	County Forces—R. M. Thurmond & Co.
725	Caldwell	4.00	Recon	28,015.46	2-24-23	County Commissioners.
731	Davie	5.46	P. C.	195,393.11	7-21-23	G. R. Martin—Heilig & Sherrill.
744	Forsyth	2.00	T. S.	15,000.00	8-10-23	Forsyth County.
751	Stokes	7.16	T. S.	*35,124.08	8-26-22	W. E. Graham.
760	Surry-Alleghany	6.9	T. S.	*32,084.18	11-5-22.	W. E. Graham.
764	Surry	1.63	R. C.	50,588.20	2—4-23	Leaksville Lumber Co.
782	Wilkes	5.97	R. C.	184,614.65	8—4-23	Hyde & Baxter.
783	Wilkes-Watauga	36.00	Gravel	159,000.00	----------	Chandler & Ragland.
785	Wilkes	2.52	P. C.	78,703.50	10-1-23	J. D. Brookshire & Co.
801	Avery	.99	W. B. Mac	22,350.24	10-26-22	Geer & Wilson.
814	Burke	8.69	S. C.	13,459.60	4-25-23	M. A .Kollock.
823	Cleveland	1.90	P. C.	*80,421.65	8-15-22	Southern Paving Co.—Z. B. Weathers & Son.
844	McDowell	2.05	P. C.	*61,233.34	12-13-21	Bolton Construction Co.
845	McDowell	7.19	Gravel	132,177.93	12-22-22	J. W. Stapp Constr. Co.-Praytor, Howton&Wood
855	Mitchell	4.72	P. C.	174,393.78	4-17-23	Fisk-Carter Construction Co.
855B	Mitchell	.....	Bridge	*22,699.85	8-22-22	Luten Bridge Co.
875	Rutherford	.....	Bridge	*6,151.61	7-18-22	Geer & Wilson
877	Rutherford	9.79	T. S.	64,563.73	8—7-22	Geer & Wilson.
878	Rutherford	6.55	T. S.	44,984.50	10-27-22	Micheaux Const. Co.—Geer & Wilson.
879	Rutherford	.....	Bridge	*6,781.99	6-21-22	Austin Bros. Bridge Co.
880	Rutherford	.....	Bridge	24,679.43	3-23-23	Austin Bros. Bridge Co.
904	Buncombe	1.60	A. C.	80,969.13	6-23-23	Asheville Paving Co.—R. C. Stevens.
910	Cherokee	7.56	Gravel	76,743.59	2-24-23	Ross Bros. Constr. Co.—W T. Moore Concrete Prod. Co.
942	Haywood	0.57	Gravel	*6,490.43	2—1-22	O'Brien Construction Co.

(*Final cost)

PROJECTS UNDER CONTRACT

NO.	COUNTY	LENGTH	TYPE	ESTIMATED COST	CONTRACTOR
108	Bertie (sheet piling)	-------	----------	$ 13,481.86	E. T. Gwathmey.
180	Perquimans	9.96	P. C.	249,192.90	Smith Brothers, Inc.
185C	Pitt	14.35	P. C.	463,802.35	Groves & Shephard.
230	Greene	5.40	P. C.	220,576.18	Smith Bros., Inc.—Pittsburg Des Moines Steel Co.
293	Wilson	8.99	P. C.	384,222.08	Smith Bros., Inc.—Pittsburg Des Moines Steel Co.
329 (FA 155)	Columbus	12.88	A. C.	422,462.60	Jas. O. Hayworth.
421	Franklin	8.23	R. C.	61,002.48	J. A. Marrow.
431	Granville	3.83	T. S.	42,895.71	Micheaux Construction Co.
506A	Alamance	0.32	Grading	9,866.45	Nello Teer.
507	Alamance	4.03	P. C.	121,966.68	Zeigler & Dalton.
592	Rockingham	8.22	P. C.	310,101.66	Zeigler & Dalton—J. L. Brinkley.
611	Anson	5.94	P. C.	176,546.00	Jas. O. Hayworth.
672	Rowan	3.54	A. C.	167,756.27	Stearns Bros., Inc.—J. A. Kreis.
679	Scotland	-------	Bridges	16,885.00	E. T. Gwathmey.
697A	Union	6.51	P. C.	301,183.80	Jas. O. Hayworth.
837B	Henderson	5.83	A. C.	83,113.14	Dixon Construction Co.
902	Buncombe	4.95	P. C.	236,111.70	Wilson Construction Co.—R. G. Rand.
930A	Graham	2.92	Gravel	12,243.00	C. M. Dicus.

STATUS OF FEDERAL AID WORK IN NORTH CAROLINA

Projects Under Construction

NO.	COUNTY	LENGTH	TYPE	ESTIMATED COST	BEGUN	CONTRACTOR
15	Guilford	4.205	Bit. Mac.	$ 5,441.75	9—1-17	County Commissioners.
61	New Hanover	2.186	P. C.	234,841.39	7-12-20	C. W. Lacy.
69	Transylvania	9.348	W. B. Mac.	231,409.04	3-25-20	Allport & Alexander Construction Co.
125A	Alleghany	4.99	Bit. Mac.	153,899.13	11-22-21	W. E. Graham.

Summary

WORK UNDER CONTRACT

Type	STATE		FEDERAL AID	
	Length	Cost	Length	Cost
P. C.	68.35	$ 2,463,703.35	.....	$ .....
R. C.	8.23	61,002.48	.....	.....
A. C.	22.25	673,332.01	.....	.....
T. S.	3.83	42,895.71	.....	.....
Gravel	2.92	12,243.00	.....	.....
Grading	.32	9,866.45	.....	.....
Bridges	-----------	16,885.00	.....	.....
Sheet piling	-----------	13,481.86	.....	.....
Total	105.90	$ 3,293,409.86	.....	.....

WORK UNDER CONSTRUCTION

P. C.	317.40	$ 10,347,634.54	2.19	$ 234,841.39
R. C.	53.40	1,927,582.93	.....	.....
A. C.	277.95	9,041,772.78	.....	.....
S. A.	34.46	364,820.00	.....	.....
Bit Mac.	64.74	1,627,164.92	9.19	159,340.88
W. B. Mac.	162.16	2,792,246.26	8.99	231,409.04
T. S.	338.94	2,674,826.41	.....	.....
S. C.	130.56	1,004,304.19	.....	.....
Gravel	172.78	2,164,950.37	.....	.....
Graded	238.24	2,072,804.65	.....	.....
Recon.	32.25	303,060.64	.....	.....
Cord	2.40	55,818.01	.....	.....
Bridges	-----------	980,940.09	.....	.....
Total	1,820.08	$ 35,320,256.25	20.37	$ 625,591.31

WORK COMPLETED

P. C.	68.44	$ 2,498,830.93	25.56	$ 889,940.67
R. C.	38.16	1,278,824.75	.....	.....
A. C.	109.54	3,105,389.34	42.29	1,521,368.25
S. A.	3.52	121,564.23	22.91	763,048.82
Bit. Mac.	10.40	7,198.07	30.62	798,895.02
W. B. Mac.	.99	22,350.24	19.04	493,880.91
Brick	9.50	217,405.72	.....	.....
T. S.	144.22	989,702.97	509.18	5,228,132.54
S. C.	44.69	179,646.89	83.90	785,198.22
Gravel	74.22	578,211.16	42.56	488,699.18
Graded	53.29	262,701.04	29.23	252,426.17
Recon.	43.20	81,427.27	.....	.....
Bridges	.....	396,547.93	.....	651,051.10
Total	600.17	$ 9,739,800.54	806.29	$ 11,872,640.88

Total Roadway Mileage 3,358.01. Total estimated cost of Roadway $58,861,429.26. Total estimated cost of Bridges $2,028,539.12. Corrected to October 1, 1923.

LEGEND

P. C.—*Plain Concrete. R. C.—*Reinforced Concrete. A. C.—*Asphaltic Concrete. S. A.—*Sheet Asphalt. Bit. Mac.—*Bituminous Macadam. W. B. Mac.—*Water Bound Macadam. T. S.—†Top Soil. S. C.—†Sand Clay. Gravel—†Gravel. Graded—†Graded. Recon.—†Reconstruction. Cord.—†Corduroy.

* Hard Surface. † "G" Type.

"Standard" Paving Asphalt

has been successfully used on some of the most important highway projects in North Carolina.

This asphalt is refined from the straight Mexican asphaltic base petroleum, its purity being over 99.8%. "STANDARD" PAVING ASPHALT meets all the tests of a paving cement for asphalt concrete or sheet asphalt pavement, its uniformity and ability to resist extremes of temperature making it especially suited for these types of construction.

"STANDARD" PAVING ASPHALT has been used in practically every large city in the east.

STANDARD OIL COMPANY
(NEW JERSEY)

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REFINERIES: Bayonne, N. J., Baltimore, Md., Charleston, S. C.

Washed and Screened
Sand Gravel Crushed Stone

Conforming to the specifications of the North Carolina State Highway Commission

Prompt shipments by rail or water

Favorable freight rates to all North Carolina points

Quotations gladly furnished on request

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Sure, It Will Pay for Itself

A Haiss Truck Loader will easily pay for itself out of the saving over hand labor, in handling 15,000 to 20,000 cubic yards of sand or crushed rock.

Loads a Yard a Minute with a One-Man Crew!

And it will keep up that speed or better, day in and day out. The Haiss Truck Loader is built strong enough to take all the punishment that a rush contracting job can hand it—and come up smiling for more.

It is self-feeding—cleans up its own path through the positive action of the Haiss feeding propellers.

The most effective digging and self-feeding device yet developed. It is self-crowding—it has slow speed gear that propels it against the pile while the buckets are digging—Every bucket digs a full load.

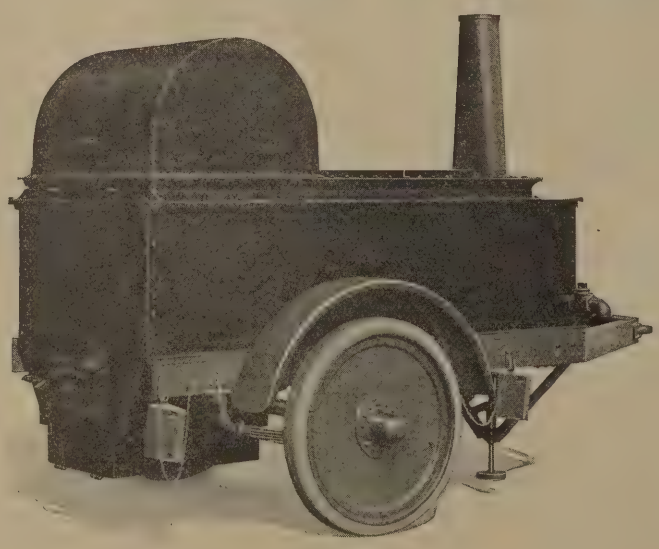
Mechanically superior—Waukesha motor, enclosed clutches, enclosed transmission, simple design and greater structural strength.

Ask for cost data on Haiss Loading—and copies of Bulletins 621 and 521.



George Haiss Manufacturing Co., Inc.
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CONVERT YOUR ARMY TRAILERS INTO USEFUL TAR *and* ASPHALT HEATERS



THE LITTLEFORD TRAIL-O-HEATER

THE LITTLEFORD TRAIL-O-HEATER

This tar and asphalt heater has been developed to meet the increasing demand for larger kettles capable of being trailed behind rapidly moving vehicles.

The Littleford Trail-O-Heater has a capacity of 300 gallons of material. It is durably constructed of plate steel and makes use of the standard Government Army Trailer for the running gear. Can be furnished ready for mounting or complete as shown. Complete description and prices on request.

Send for our catalogue of Road and Street Maintenance Equipment.

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Long Years *of* Life Ahead *of* Them



National Lock-Joint Cast-Iron Pipe

The Pipe *of* Short Units, Long Service *and* Low Costs

The Pipe that locks effectively, that prevents Separation and assures alignment to perfection.

The pipe which solves culvert renewal problems with least expense, greatest efficiency. The pipe that does not rot or disintegrate, the pipe that is mechanically correct and has proved itself the solution of the culvert problem.

CONTRACTORS *and* ENGINEERS, GET THIS:

TWO MEN, without the use of any tools whatsoever, will unload, handle and install all sizes up to and including 36 inches in diameter.

It is as cheap to handle and install as clay pipe WITH NO BREAKAGE LOSS. In shallow trench work the entire culvert can be built up, interlocked and rolled into place in one operation.



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LEHIGH CEMENT

FOLLOWING closely the natural demand for cement, and offering advantages in the way of service and shipping facilities, are the sixteen great Lehigh mills stretching from coast to coast.

This nation-wide distribution makes Lehigh Cement readily available to practically any locality, thus insuring uniformity of material and prompt delivery to any job. Lehigh's square-deal policy is added assurance of satisfaction in the use of Lehigh—The National Cement.

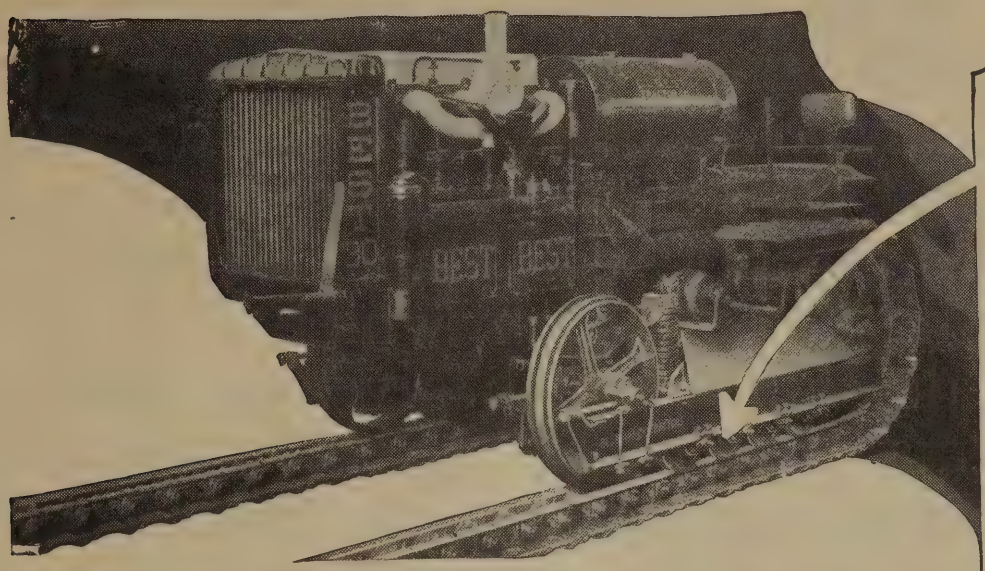
16 MILLS FROM COAST TO COAST

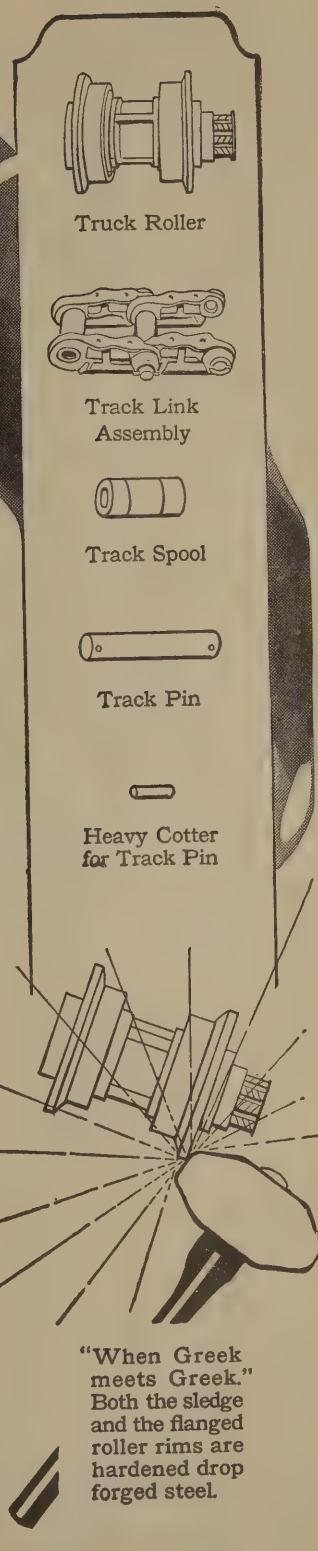


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TRUCK ROLLERS *that* LAST!

THE DRIVING WHEELS of the most powerful locomotives have forged steel rims.

The Truck Rollers of a track type tractor support the weight of the tractor and the flanges of rollers must withstand severe jars and side strains of side hill work and rough going.

On Best Tractors the flanged rims of truck rollers are drop forgings—nothing less—forged into shape under heavy steam hammers, from heated steel of special analysis. After being forged the rims are annealed, bored and reamed, then turned true on the outside tread. They are next shrunk on accurately machined hubs—being hardened at the same time—hardened to resist battering blows just as are the heads of first-class forged hammers or sledges.

The rollers, complete, are mounted on anti-friction bearings to insure easy running, bearings with seals to retain lubricant and to prevent entrance of sand and ruinous grit.

The truck rollers of Best Tractors run over tracks which are true and straight. Tracks are made from drop forged hardened links which have been accurately machined top and bottom and large hardened spools and pins at each joint contribute to the long life which may be expected from the tracks on Best Tractors.

"When Greek meets Greek." Both the sledge and the flanged roller rims are hardened drop forged steel.

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IN twenty years Portland cement has advanced from comparative insignificance to the leading position in the construction material field. The ready adaptability of Portland cement to every kind of construction, from fence posts on the farm to gigantic dams and highways of endurance; the facility with which it can be handled; its durability which gives the highest degree of permanence, backed up by constant attention to perfection in manufacture and the most intelligent and comprehensive educative and advertising work that has ever been given to any building material, all combine to account for the remarkable progress achieved by the Portland cement industry. We take just pride in having always kept faith with the sound principles followed by this great industry.

Every requirement for the manufacture of the high standard of quality laid down by the established scientific standard specifications is rigidly followed in making Clinchfield Portland cement. Service in the fullest meaning of the word is our watchword in dealing with our customers.

Builded upon this firm foundation of quality and service the Clinchfield plant has steadily grown and expanded and its products have been used with constant satisfaction for all classes of construction work in the South.

CLINCHFIELD PORTLAND CEMENT CORPORATION
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115 Miles of Texaco Asphalt On A Single Southern Highway

The longest and most important route of the North Carolina State Highway System is Route 10, or as it is more commonly called, the Central Highway.

The Central Highway extends for 600 miles through the different sections fo North Carolina and carries much of the tremendous traffic associated with agriculture and industry in this State.



TEXACO Asphaltic Concrete on a section of the Central Highway in Buncombe County constructed two years ago.

As a result of the zeal with which North Carolina has applied itself to the perfection of a State system of roads, more than one-third of the Central Highway now is hard surfaced.

115 miles of the improved sections of this important route are paved with TEXACO Asphalt.

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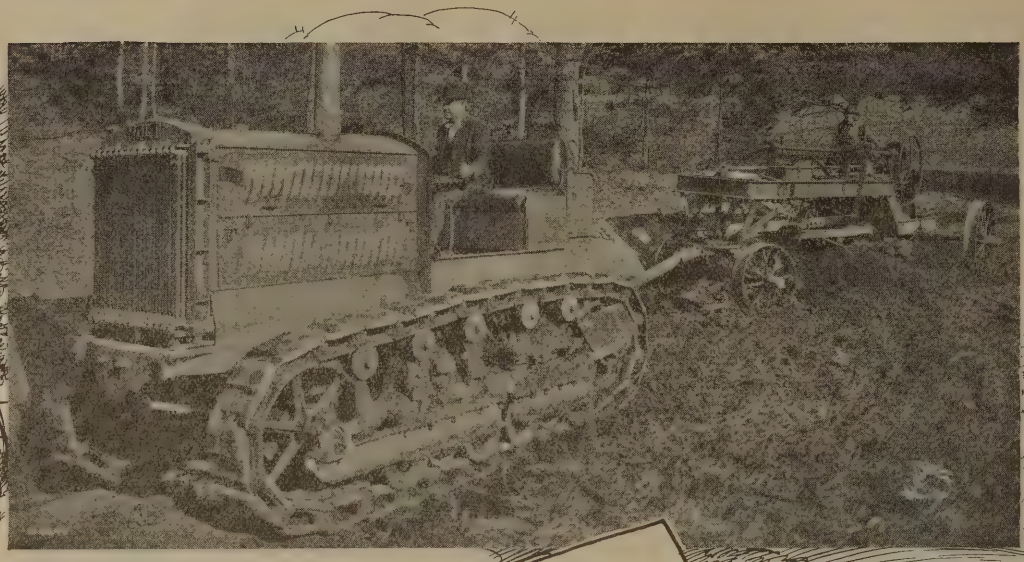
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A REAL OUTFIT ON REAL ROAD WORK

BUNCOMB COUNTY COMMISSIONERS

ASHEVILLE N.C.MAY 15th.1923

Some time ago the Commissioners of Buncomb County decided that there must be some faster,better and more economical way to widen and maintain County roads than by the old mule and hand labor method. After some investigation we decided to use tractors and the next thing for us to decide was what tractor and what grader would do the most work for the least amount of money for upkeep and operation, as we realized that the first cost is usually the small end of equipment.

We advertised for bids and found that there were more makes of tractors and graders than we had ever dreamed of, so after several trips and much investigation, both mechanical and as to service we decided to purchase one ten Holt Caterpillar Tractor and one Stockland Giant Ton Holt Caterpillar Tractor, for our heavy outfit.

Foot Grader, for our heavy outfit.

This equipment was delivered and put to work in a very short time after the order was given, and has been surpassing our fondest hopes ever since.

The Tractor is flexible, easy riding and its abundant power for the heaviest work, yet with its three speeds forward and spring mounting it is very fast for such large machine.

The Grader is equally as strong as the Tractor is powerful, as we have never broken a thing. We find that the Quicklift is a great time-saver, as you do not have to stop for bridges and culverts. After using this combination on our own roads, we are thoroughly convinced that we made the right selection and we would heartily advise any County to profit by our experience and do likewise.

Buncomb County Commissioners,

E. M. Lyda Chairman.

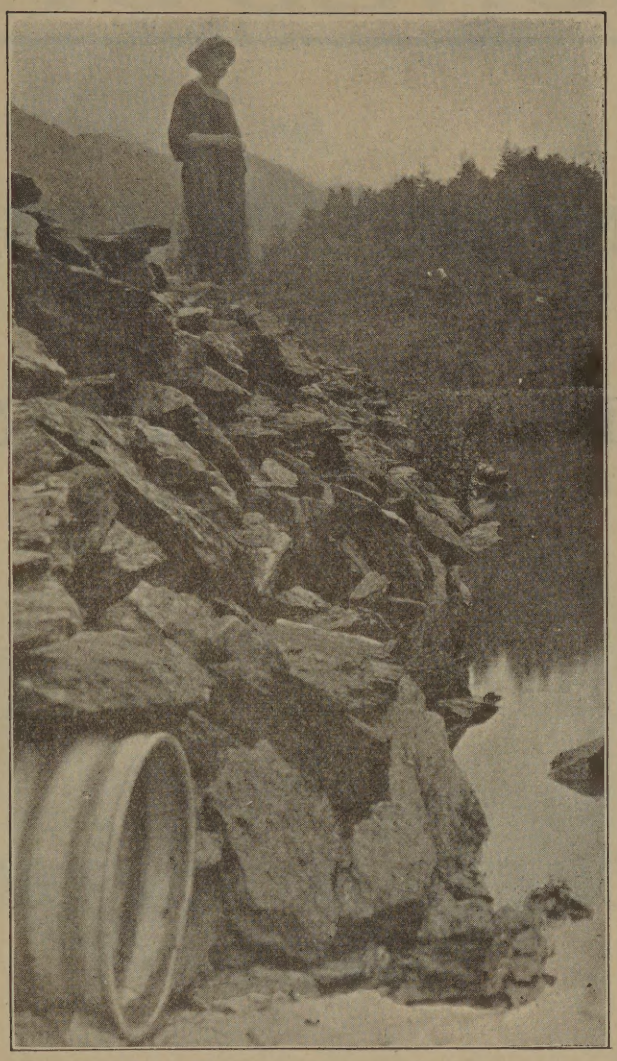
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The rugged strength and elasticity of this Armco Culvert enable it to hold up tons of rock on this mountain road above the clouds.

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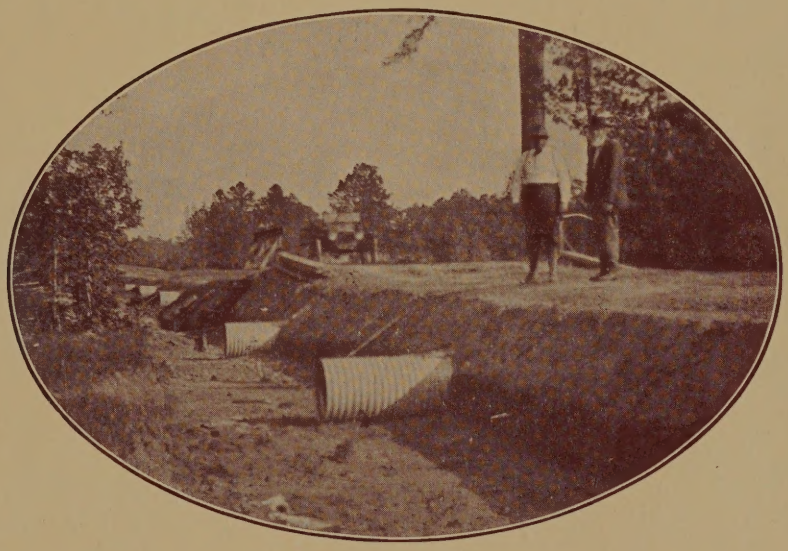
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"GENUINE OPEN HEARTH IRON"

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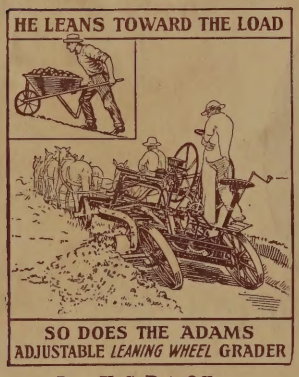
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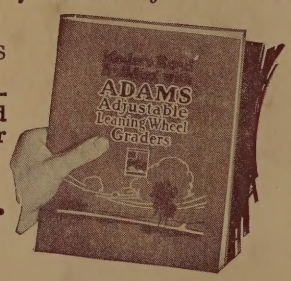
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